US 60 | US 70 | US 191 CORRIDOR PROFILE STUDY

FLORENCE JUNCTION (SR 79) TO DOUGLAS

ADOT Work Task No. MPD-029-16
ADOT Contract No. DT11-013154

DRAFT WORKING PAPER 6: SOLUTION EVALUATION AND PRIORITIZATION

NOVEMBER 2016

PREPARED FOR:

ARIZONA DEPARTMENT OF TRANSPORTATION

PREPARED BY:

This report was funded in part through grants from the Federal Highway Administration, U.S. Department of Transportation. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data, and for the use or adaptation of previously published material, presented herein. The contents do not necessarily reflect the official views or policies of the Arizona Department of Transportation or the Federal Highway Administration, U.S. Department of Transportation. This report does not constitute a standard, specification, or regulation. Trade or manufacturers' names that may appear herein are cited only because they are considered essential to the objectives of the report. The U.S. government and the State of Arizona do not endorse products or manufacturers.

TABLE OF CONTENTS

1.0 INTRODUCTION **1**

1.1 Corridor Study Purpose 1
1.2 Study Goals and Objectives 1
1.3 Working Paper 6 Overview 1
1.4 Corridor Overview and Location 1
1.5 Corridor Segments 1

2.0 CANDIDATE SOLUTION EVALUATION PROCESS **5**

2.1 Life-Cycle Cost Analysis 5
2.2 Performance Effectiveness Evaluation 5
2.3 Solution Risk Analysis 5
2.4 Candidate Solution Prioritization 5

3.0 SOLUTION EVALUATION AND PRIORITIZATION **6**

3.1 Candidate Solutions 6
3.2 Life-Cycle Cost Analysis 9
3.3 Performance Effectiveness Evaluation 11
3.4 Solution Risk Analysis 14
3.6 Candidate Solution Prioritization 15

4.0 SUMMARY OF CORRIDOR RECOMMENDATIONS **16**

4.1 Prioritized Candidate Solution Recommendations 16
4.2 Other Corridor Recommendations 16
4.3 Policy and Initiative Recommendations 16
4.4 Next Steps 19

LIST OF TABLES

Table 1: US 60|US 70|US 191 Corridor Segments 2
Table 2: Candidate Solutions 7
Table 3: Bridge LCCA Results 10
Table 4: Pavement LCCA Results 10
Table 5: Performance Effectiveness Scores 13
Table 6: Prioritized Recommended Solutions 17

LIST OF FIGURES

Figure 1: Corridor Study Area 1
Figure 2: Corridor Location and Segments 4
Figure 3: Candidate Solution Evaluation Process 5
Figure 4: Risk Matrix 14
Figure 5: Numeric Risk Matrix 14
Figure 6: Prioritized Recommended Solutions 18

APPENDICES

Appendix A: Candidate Solution Cost Estimates
Appendix B: Life-Cycle Cost Analysis
Appendix C: Crash Modification Factors and Factored Unit Construction Costs
Appendix D: Performance Area Risk Factors
Appendix E: Performance Effectiveness Scores
Appendix F: Solution Prioritization Scores

ACRONYMNS & ABBREVIATIONS

ABBREVIATION	NAME
ADOT	Arizona Department of Transportation
CCTV	Closed Circuit Television
CPS	Corridor Profile Study
DMS	Dynamic Message Sign
EB	Eastbound
I	Interstate
IRI	International Roughness Index
LCCA	Life-Cycle Cost Analysis
MP	Milepost
MPD	Multimodal Planning Division
NPV	Net Present Value
P2P	Planning to Programming
PES	Performance Effectiveness Score
PTI	Planning Time Index
PS	Prioritization Score
ROW	Right-of-Way
RWIS	Road Weather Information System
SPRR	Southern Pacific Railroad
SR	State Route
TTI	Travel Time Index
TPTI	Truck Planning Time Index
TTTI	Truck Travel Time Index
UP	Underpass
VMT	Vehicle-miles Travelled
WB	Westbound
WIM	Weigh-in-Motion

1.0 INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of US Route 60|US 70: SR 79 to US 191 and US 191: US 70 to SR 80 (US 60|US 70|US 191). This study examines key performance measures relative to the US 60|US 70|US 191 corridor, and the results of this performance evaluation are used to identify potential strategic improvements.

The intent of the corridor profile program, and of ADOT's Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT is conducting eleven CPS within three separate groupings.

The first three studies (Round 1) began in Spring 2014, and encompass:

- I-17: SR 101L to I-40
- I-19: Nogales to I-10
- I-40: California State Line to I-17

The second round (Round 2) of studies, initiated in Spring 2015, includes:

- I-8: California State Line to I-10
- I-40: I-17 to the New Mexico State Line
- SR 95: I-8 to I-40

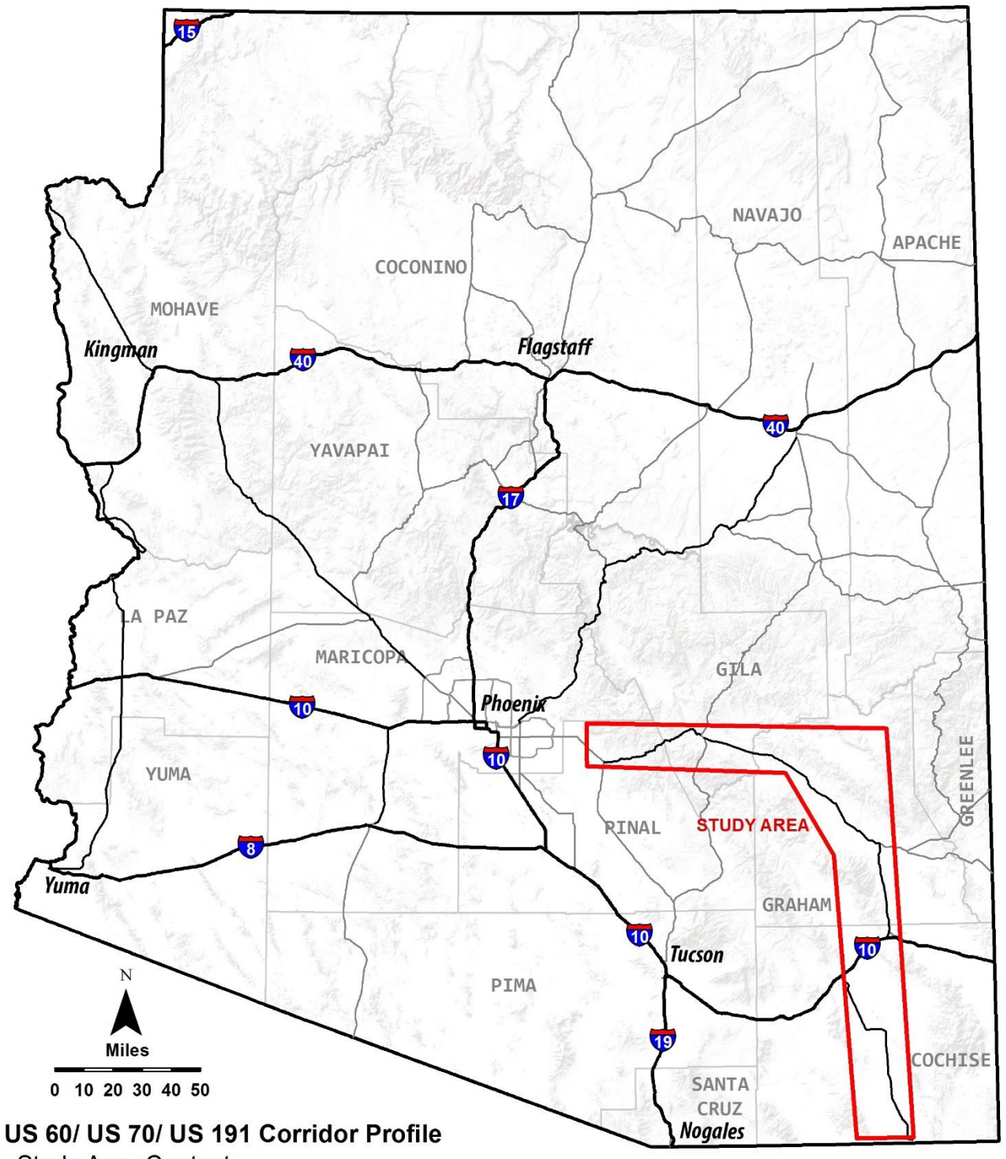
The third round (Round 3) of studies, initiated in Fall 2015, includes:

- I-10: California State Line to SR 85 and SR 85: I-10 to I-8
- I-10: SR 202L to the New Mexico State Line
- SR 87/SR 260/SR 377: SR 202L to I-40
- US 60/US 70: SR 79 to US 191 and US 191: US 70 to SR 80
- US 93/US 60: Nevada State Line to SR 303L

The studies under this program assess the overall health, or performance, of the state's strategic highways. The CPS identifies candidate solutions for consideration in the Multimodal Planning Division's (MPD) P2P project prioritization process, providing information to guide corridor-specific project selection and programming decisions.

The US 60|US 70|US 191 corridor, depicted in **Figure 1**, is one of the strategic statewide corridors and the subject of this Round 3 CPS.

Figure 1: Corridor Study Area



US 60/ US 70/ US 191 Corridor Profile
Study Area Context

1.1 Corridor Study Purpose

The purpose of the US 60|US 70|US 191 CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation

1.2 Study Goals and Objectives

The objective of this study is to identify a recommended set of prioritized potential strategic solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The US 60|US 70|US 191CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance. Corridor benefits can be categorized by the following three investment types:

- Preservation: Activities that protect transportation infrastructure by sustaining asset condition or extending asset service life
- Modernization: Highway improvements that upgrade efficiency, functionality, and safety without adding capacity
- Expansion: Improvements that add transportation capacity through the addition of new facilities and/or services

This study identifies potential actions to improve the performance of the US 60|US 70|US 191 corridor. Proposed actions are compared based on their likelihood of achieving desired performance levels, life-cycle costs, and cost-effectiveness to produce a prioritized list of solutions that help achieve corridor goals.

The following goals are identified as the desired outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

1.3 Working Paper 6 Overview

The objective of Working Paper 6 is to document the evaluation of the strategic solutions identified in Working Paper 5 for the US 60|US 70|US 191 corridor. Pavement and Bridge solutions are evaluated using a Life-Cycle Cost Analysis (LCCA). In addition, this evaluation includes a risk-based Performance Effectiveness Evaluation on each solution to determine the amount of benefit to the performance scores each solution produces. The result of this evaluation is a prioritized list of recommendations for the US 60|US 70|US 191 corridor.

1.4 Corridor Overview and Location

The US 60|US 70|US 191 corridor links the Mexico border at the City of Douglas and the Phoenix metropolitan area to agricultural, mining and recreational activity in southeastern Arizona. In general, all three highways are two-lane facilities designed for relatively modest traffic volumes in a rural setting. At the same time, the corridor offers some unique benefits within the Arizona circulation system that could be leveraged for increased usage as the need arises.

US 191 provides a link between Mexico and Interstate 10 (I-10), the primary east-west interstate corridor along the southern states. As a result, US 191 serves as a major freight corridor for goods moving between Mexico and the United States. Similarly, the combination of US 191 and US 70 between I-10 and Globe offers a critical connection to mining and agricultural interests located in the greater Safford and Globe areas of Graham and Pinal Counties. US 60 between Globe and SR 79 links activities within the corridor to the major population and commerce center of the Phoenix metropolitan area.

The combination of all three highways (US 60|US 70|US 191) creates a potentially significant alternative to I-10 and I-19 for travel in the eastern reaches of Arizona. A seamless connection among the three routes as a reliever could have major implications for improving international, interstate and intrastate trade along with opening access to financial and commercial distribution centers in the Phoenix area. It would also provide enhanced accessibility to tourist and recreational opportunities in southeastern Arizona.

1.5 Corridor Segments

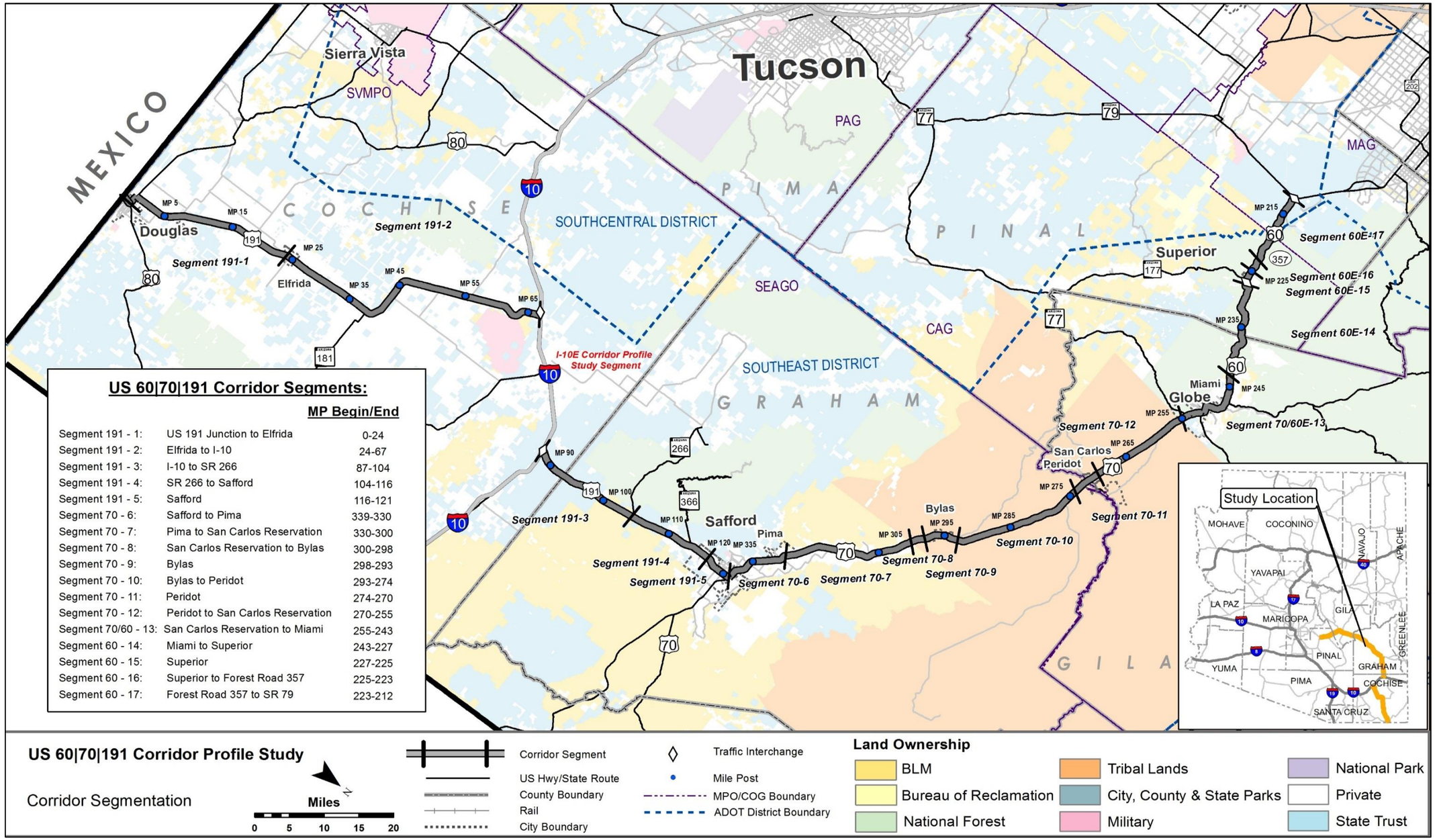
The US 60|US 70|US 191 Corridor Profile Study limits extend along US 191 from Douglas to I-10, continuing along US 191 from I-10 to Safford to the junction with US 70, then following US 70 from Safford, passing through the San Carlos Apache Reservation to Globe, and transitioning to the US 60 from Globe, through Superior to Florence Junction at the US 60|SR 79 intersection. Study segments were identified based on consideration of roadway, traffic and jurisdictional characteristics to allow for an appropriate level of analysis for segments of similar operating environments. Seventeen segments have been identified by the project team. Table 1 (Page 3) and the Corridor Map (Figure 2, Page 5) describe these segments, including general characteristics such as location, and average daily traffic (ADT).

Table 1: US 60|US 70|US 191 Corridor Segments

Segment #	Begin	End	Approximate Begin Milepost	Approximate End Milepost	Approximate Length (miles)	Typical Through Lanes	2014 Average Annual Daily Traffic Volume (vpd)	Character Description
US 191 (MP 0 to MP 66.84 and MP 87.48 to MP 121.02)								
191B – 1A	U.S. Mexico Border	US 191 Junction	0	1	1	4	8,000 – 13,000	This segment begins at the Douglas Port of Entry and continues north along US 191B (Pan American Avenue) until the intersection with US 191 (16th Street). The high traffic counts can be attributed to the international border crossing as well as the mixed industrial/commercial/residential uses along the route. This segment will not be included in this study as the facility is currently being turned over from ADOT to Douglas.
191-1	US 191B Junction	Elfrida	0	24	24	2	1,000 – 2,000	Starting from MP 0 along US 191, this segment is primarily rural in nature, but is the only route to the Bisbee-Douglas International Airport.
191-2	Elfrida	I-10	24	67	43	2	1,000 – 2,000	Beginning in Elfrida, a census-designated place, this segment connects smaller agricultural communities to each other and I-10.
191-3	I-10	SR 266	87	104	17	4	2,000	No known developments exist along this segment however, it does connect the Arizona State Prison at Fort Grant to I-10 via SR 266.
191-4	SR 266	Safford City Limit	104	116	12	2	3,000 – 7,000	Land along this segment is primarily owned by the Bureau of Reclamation and is therefore undeveloped. The segment begins at SR 266 and ends at approximately the southern limits of Safford. Traffic numbers in this segment increase due to the development south of Safford.
191-5	Safford City Limit	US 70 Junction	116	121	5	4	8,000 – 9,000	This segment starts at approximately the southern limits of Safford and ends at the junction with US 70. The segment is differentiated by jurisdiction and change in route along the corridor rather than any changes in terrain or traffic.
US 70 (MP 252.14 to MP 314.21Back = MP 325.31 Ahead to MP 339.46)								
70-6	US 191 Junction	Pima	339	330	9	4	5,000 – 23,000	Beginning at the junction with US 191 in Safford and ending at the northern limit of Pima, this segment has very high traffic volumes which can be attributed to the higher density of surrounding communities and agricultural/mining operations. A large majority of the land abutting the route is privately owned.
70-7	Pima	San Carlos Apache Reservation	330	300	19	2	3,000 – 5,000	This segment connects the western limit of Pima to the eastern edge of the San Carlos Apache Reservation. A majority of the land abutting US 70 is privately owned and used for agricultural purposes. Milepost equation MP 314.21 Back = MP 325.31 Ahead occurs within this segment.
70-8	San Carlos Apache Reservation	Bylas	300	298	2	2	3,000	Beginning at the eastern limits of the San Carlos Apache Reservation, this short segment terminates at the eastern limits of Bylas.
70-9	Bylas	Bylas	298	293	5	2	3,000	Bylas is a census-designated place within the San Carlos Apache Reservation. The boundary of this segment was determined by the extent of development and not necessarily the jurisdictional limits.

Segment #	Begin	End	Approximate Begin Milepost	Approximate End Milepost	Approximate Length (miles)	Typical Through Lanes	2014 Average Annual Daily Traffic Volume (vpd)	Character Description
70-10	Bylas	Peridot	293	274	19	2	3,000	This segment begins at the western extent of development in Bylas and extends to the eastern limits of development in Peridot. The segment is within the San Carlos Reservation and has low traffic volume.
70-11	Peridot	Peridot	274	270	4	2	3,000	The segment starts at the new medical center at the eastern limits of Peridot and extends west to the high school. It is differentiated by Graham/Gila County jurisdiction rather than changes in terrain or traffic.
70-12	Peridot	San Carlos Apache Reservation	270	255	15	2	4,000 – 7,000	Beginning at the Peridot High School and continuing to the western limit of the San Carlos Apache Reservation, this segment is differentiated by jurisdiction rather than any changes in terrain or traffic.
70|60-13	San Carlos Apache Reservation	Miami	255	243	12	4	3,000 – 28,000	Beginning at the western limits of the San Carlos Apache Reservation, this segment goes through the City of Globe, Claypool and Miami. Although this segment includes US 70 and US 60, there is no change in cross section therefore, the segment is differentiated by jurisdiction rather than any other changes. Higher traffic counts are due to the junction of US 60 and US 70 along with higher traffic counts and the proximity of large mines.
US 60 (MP 212.17 to MP 252.23)								
60-14	Miami	Superior	243	227	16	2	7,000 – 9,000	Beginning at the western limits of Miami and extending to the eastern limits of Superior, this segment bisects the Tonto National Forest. The high traffic volume can be attributed to a significant number of regular commuters in both directions (Valley to Globe) and tourist traffic.
60-15	Superior	Superior	227	225	2	2	10,000	This segment starts and ends at approximately the eastern and western limits of Superior. This segment is differentiated by jurisdiction rather than any changes in terrain or traffic.
60-16	Superior	Forest Road 357	225	223	2	2	9,000	This segment is bounded by the Tonto National Forest and is differentiated by the number of thru east and west lanes rather than changes in terrain or jurisdiction.
60-17	Forest Road 357	SR 79	223	212	11	2	10,000	Although this segment is generally flat in nature, it is differentiated by the number of thru lanes, compared to 60-16. Beginning at State Forest Road 357, this segment terminates at the interchange with SR 79.

Figure 2: Corridor Location and Segments



2.0 CANDIDATE SOLUTION EVALUATION PROCESS

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation are shown in **Figure 3** and described more fully below.

2.1 Life-Cycle Cost Analysis

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA can eliminate options from further consideration and identify which options should be carried forward for further evaluation.

When multiple independent candidate solutions are developed for Mobility, Safety, or Freight strategic investment areas, these candidate solution options advance directly to the Performance Effectiveness Evaluation without an LCCA.

2.2 Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

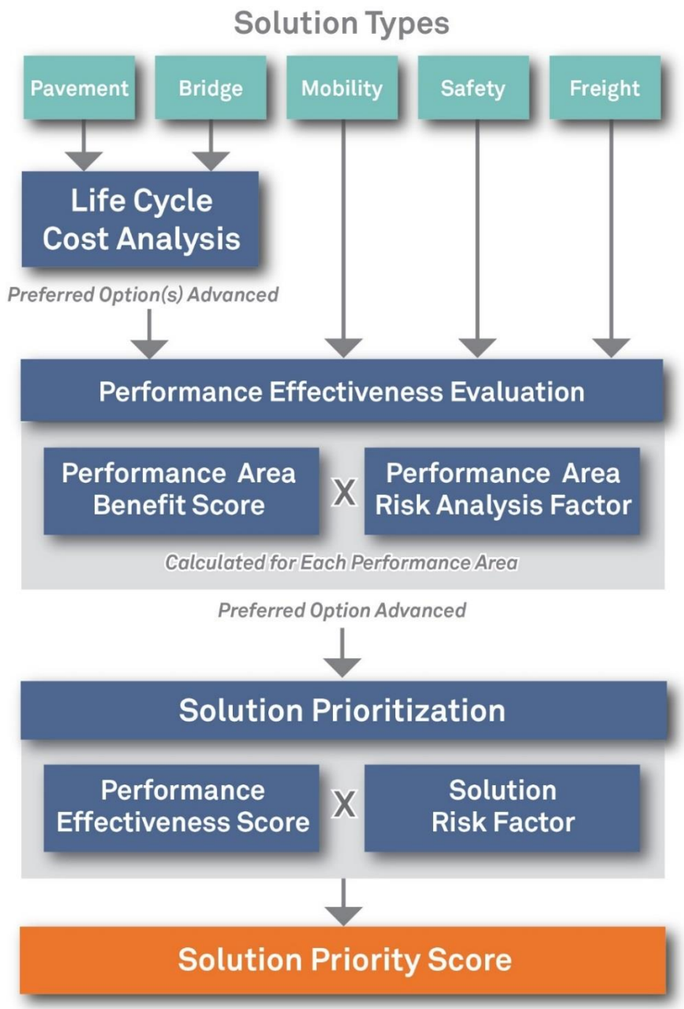
2.3 Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of the performance failure.

2.4 Candidate Solution Prioritization

The PES, weighted risk factor, and average segment need score are combined to create a prioritization score. The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure 3: Candidate Solution Evaluation Process



3.0 SOLUTION EVALUATION AND PRIORITIZATION

3.1 Candidate Solutions

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State's key transportation corridors. For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution: preservation, modernization, or expansion.

The performance system and performance needs previously documented in Working Papers 2 and 4, respectively, serve as a foundation for developing candidate solutions for corridor preservation, modernization, and expansion.

Candidate solutions are not intended to recreate or replace results from normal programming processes. However, they should address elevated levels (High or Medium) of need and focus on investments in modernization projects to optimize current infrastructure. Ideally, strategic solutions should address overlapping needs and reduce costly repetitive maintenance. In addition, they should provide a measurable benefit.

Candidate solutions were developed after considering information from previous reports, field reviews, ADOT staff input, observable trends in the performance data, current standards, national and local best practices, and engineering judgement. **Table 2** identifies each strategic location that has been assigned a candidate solution with a number (e.g., CS191.1, CS70.4, etc.). Each candidate solution is comprised of one or more components to address the identified needs. Cost estimates for each candidate solution are provided in **Appendix A**.

Following the distribution of Draft Working Paper 5, candidate solutions were reviewed based on location, solution characteristics, and length. The following considerations were also made:

- Solutions that affect a specific subset of crashes (e.g. lighting, wildlife crossing or fencing) should be separated from other solutions and considered by themselves.
- Solutions that have an elevated crash modification factor (e.g. <0.50) should be separated from other solutions and considered by themselves (e.g. mainline realignment, parallel entry/exit ramps).
- Solutions should be packaged together by location/geography to the extent possible.

This analysis may have resulted in the combination or modification of the solutions presented in Working Paper 5.

Table 2: Candidate Solutions

Candidate Solution #	Segment #	Location #	Beginning MP	Ending MP	Candidate Solution Name	Option	Scope	Investment Category Preservation (P) Modernization (M) Expansion (E)
CS191.1	191-2	L4	59.9	64	US 191 Elfrida to I-10 Freight Mitigation	A B	Widen shoulders, realign roadway from MP 59.9 to MP 64.2, and replace Cochise RR bridge Construct passing lanes, realign roadway from MP 59.9 to MP 64.2, and replace Cochise RR bridge	M
CS191.2	191-5	L10	117	121	US 191 Safford Safety Improvements	-	Intersection improvements, focusing on: • Armory Road Intersection (MP 118): Improve signal visibility, install warning signs with beacons in advance of intersection • Discovery Park Intersection (MP 119): Improve signal visibility, dynamic speed warning signs • Lone Star Intersection (MP 119.5): Install signal with crosswalk and lighting, install warning signs with beacons in advance of intersection • 16th Street (MP 120.5): Install warning signs with beacons in advance of intersection	M
CS70.3	70-5	L14	283	284	US 70 San Carlos Pavement Improvement	A B	Replace Pavement Rehabilitate Pavement	P P
CS70.4	70-10	L15	268	292	US 70 San Carlos Safety Improvements	-	Install high-visibility edge line striping Install high-visibility signage Install warning signs with beacons at curves and speed feedback signs (MP 292, 280, 278.5) Install warning signs and speed feedback signs entering high pedestrian area (WB MP 273, EB 269) Install centerline rumble strip Install rumble strip Shoulder widening and install safety edge Construct passing lanes (EB MP 262 - 264 and WB MP 282 - 288) Formalize pullouts (signage, ROW for pullouts) (WB MP 274.5, EB MP 279, EB MP 289, WB 292)	M
CS70.5	70-12	L16	257	260	US 70 Cutter Safety Improvements	-	Widen shoulder, install rumble strip and safety edge Install warning signage in advance of intersection (EB MP 259 and WB MP 260) Construct center lane (MP 258 – 259) Install lighting	M
CS60.6	70|60-13	L19	249.80	249.80	US 60 Pinal Creek Bridge (No. 36)	A B	Replace bridge Rehabilitate bridge	M M
CS60.7	70|60-13	L20	249.64	249.64	US 60 Pinal Creek Bridge (No. 266)	A B	Replace bridge Rehabilitate bridge	M M

Candidate Solution #	Segment #	Location #	Beginning MP	Ending MP	Candidate Solution Name	Option	Scope	Investment Category Preservation (P) Modernization (M) Expansion (E)
CS60.8	70|60-13	L22	244.5	250	US 60 Globe-Miami Safety Improvements	-	Install lighting Install speed feedback signs (MP 246 - 250) Install warning signs with beacons in advance of SR 188 intersection Rehabilitate pavement (MP 249 – 251)	M
CS60.9	70|60-13	L24	253.63	253.63	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	A B C	Replace bridge Provide ramp Reprofile mainline	M
CS60.10	60-14	L27	227.71	227.71	US 60 Queen Creek Bridge (No. 406)	A B	Replace bridge Rehabilitate bridge	M
CS60.11	60-14	L28	229.50	229.50	US 60 Waterfall Canyon Bridge (No. 328)	A B	Replace bridge Rehabilitate bridge	M
CS60.12	60-14	L30/L32	227	243	US 60 Superior to Miami Mobility and Freight Mitigation	A B C	Widen shoulder, install rock-fall mitigation and dynamic weather warning beacons **Note: Queen Creek Tunnel limits omitted from solution (MP 228.3 – 228.5)* EB climbing/passing lane (MP 227-227.9, MP 230.4 – 232.6), WB climbing/passing lane (MP 236.4 – 236.6, MP 238.1 – 239.5), Five-lane widening (MP 234.2 – 236.4), install rock-fall mitigation and dynamic weather warning beacons Construct four-lane divided (using 2 existing-lanes for one direction)	M E E
CS60.13	60-14	L31	232	234	US 60 Top-of-the-World Safety Improvements	-	Install warning signage and speed feedback signs Install high visibility edge line striping Improve sign visibility Install centerline rumble strip	M
CS60.14	60-14	L31	227	229	US 60 Queen Creek Safety Improvements	-	Widen shoulder and install rumble strip and safety edge Install guardrail Install warning signage and speed feedback signs Install high visibility edge line striping Improve sign visibility Install centerline rumble strip **Note: Queen Creek Tunnel limits omitted from solution (MP 228.3 – 228.5)*	M

*'-' indicates only one solution is being proposed and no options are being considered

3.2 Life-Cycle Cost Analysis

LCCA is conducted for any candidate solution that is developed as a result of a need in the Pavement or Bridge performance area. The intent of the LCCA is to determine which options warrant further investigation and eliminate options that would not be considered strategic.

LCCA is an economic analysis that compares cost streams over time and presents the results in a common measure, the present value of all future costs. The cost stream occurs over an analysis period that is long enough to provide a reasonably fair comparison among alternatives that may differ significantly in scale of improvement actions over shorter time periods. For both bridge and pavement LCCA, the costs are focused on agency (ADOT) costs for corrective actions to meet the objective of keeping the bridge or pavement serviceable over a long period of time.

LCCA is performed to provide a more complete holistic perspective on asset performance and agency costs over the life of an investment stream. This approach helps ADOT look beyond initial and short-term costs that often dominate the considerations in transportation investment decision-making and programming.

Bridge LCCA

For the bridge LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected bridges, as described below:

- Bridge replacement (large upfront cost but small ongoing costs afterwards)
- Bridge rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- On-going repairs until replacement (low upfront and ongoing costs until replacement)

The bridge LCCA model developed for the CPS reviews the characteristics of the candidate bridges including bridge ratings and deterioration rates to develop the three improvement strategies (full replacement, rehabilitation until replacement, and repair until replacement). Each strategy consists of a set of corrective actions that contribute to keeping the bridge serviceable over the analysis period. Cost and effect of these improvement actions on the bridge condition are essential parts of the model. Other considerations in the model include bridge age, elevation, pier height, length-to-span ratio, skew angle, and substandard characteristics such as shoulders and vehicle clearance. The following assumptions are included in the bridge LCCA model:

- The bridge LCCA only addresses the structural condition of the bridge and does not address other issues or costs
- The bridge will require replacement at the end of its 75-year service life regardless of current condition
- The bridge elevation, pier height, skew angle, and length-to-span ratio can affect the replacement and rehabilitation costs
- The current and historical ratings are used to estimate a rate of deterioration for each candidate bridge
- Following bridge replacement, repairs will be needed every 20 years
- Different bridge repair and rehabilitation strategies have different costs, expected service life, and benefit to the bridge rating
- The net present value of future costs is discounted at 3% and all dollar amounts are in 2015 dollars
- If the LCCA evaluation recommends rehabilitation or repair, the solutions is not considered strategic and the rehabilitation or repair will be addressed by normal programming processes
- Because this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA net present value results that are within 15% should be considered equally: in such a case, the project should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed

Based on the candidate solutions presented in **Table 2**, LCCA was not conducted for any bridges on the US 60|US 70|US 191 corridor. A summary of this analysis is shown in **Table 3**. Additional information regarding the LCCA is included in **Appendix B**.

Pavement LCCA

The LCCA approach to pavement is very similar to the process used for bridges. For the pavement LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected pavement, as described below:

- Pavement replacement (large upfront cost but small ongoing costs afterwards – could be replacement with asphalt or concrete pavement)
- Pavement major rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- Pavement minor rehabilitation until replacement (low upfront and ongoing costs until replacement)

The pavement LCCA model developed for the CPS reviews the characteristics of the candidate paving locations including the historical rehabilitation frequency to develop potential improvement strategies (full replacement, major rehabilitation until replacement, and minor rehabilitation until replacement, for either concrete or asphalt, as applicable). Each strategy consists of a set of corrective actions that contribute to keeping the pavement serviceable over the analysis period. The following assumptions are included in the pavement LCCA model:

- The pavement LCCA only addresses the condition of the pavement and does not address other issues or costs
- The historical pavement rehabilitation frequencies at each location are used to estimate future rehabilitation frequencies
- Different pavement replacement and rehabilitation strategies have different costs and expected service life
- The net present value of future costs is discounted at 3% and all dollar amounts are in 2015 dollars
- If the LCCA evaluation recommends rehabilitation or repair, the solution will not be considered strategic and the rehabilitation will be addressed by normal programming processes
- Because this LCCA is conducted at a planning level, and due to variabilities in costs and improvement strategies, the LCCA net present value results that are within 15% should be considered equally; in such a case, the project should be carried forward as a strategic replacement project - more detailed scoping will confirm if replacement or rehabilitation is needed.

Based on the candidate solutions presented in **Table 2**, LCCA was conducted for one pavement project on the US 60|US 70|US 191corridor. A summary of this analysis is shown in **Table 4.** Additional information regarding the pavement LCCA is contained in **Appendix B.**

As shown in **Table 3** and **Table 4**, the following conclusions were determined based on the LCCA:

- Replacement is the only viable option for the following bridges due since their service life has expired (75-years) or will expire prior to the next possible programming year.
    - US 60 Pinal Creek Bridge (No. 36) – Built in 1920
    - US 60 Pinal Creek Bridge (No. 266) – Built in 1942
    - US 60 Queen Creek Bridge (No. 406) – Built in 1949
    - US 60 Waterfall Canyon Bridge (No. 328) – Built in 1929

- Pavement rehabilitation was the most cost effective option for improving the pavement quality between MP 283 and MP 284 on US 70.

Table 3: Bridge LCCA Results

Candidate Solution	Present Value at 3% Discount Rate ($)			Ratio of Present Value Compared to Lowest Present Value			Other Needs	Results
	Replace	Rehab	Repair	Replace	Rehab	Repair		
US 60 Pinal Creek Bridge (No. 36)	$2,501,301	**-**	-	1.00	-	-	-	Considered a strategic solution to replace the bridge
US 60 Pinal Creek Bridge (No. 266)	$3,297,230	-	**-**	1.00	-	-	-	Considered a strategic solution to replace the bridge
US 60 Queen Creek Bridge (No. 406)	$9,322,474	**-**	-	1.00	-	-	-	Considered a strategic solution to replace the bridge
US 60 Waterfall Canyon Bridge (No. 328)	$1,600,870	-	**-**	1.00	-	-	-	Considered a strategic solution to replace the bridge

Table 4: Pavement LCCA Results

Candidate Solution	Present Value at 3% Discount Rate ($)				Ratio of Present Value Compared to Lowest Present Value				Other Needs	Results
	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehabilitation	Asphalt Light Rehabilitation	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehabilitation	Asphalt Light Rehabilitation		
US 60 San Carlos Pavement Improvement (CS70.3, MP 283 to 284)	$4,395,411	$4,052,390	$3,307,010	$3,401,615	1.40	1.28	1.00	1.09	No	Reconstruction is not within 15% of lowest cost - Rehabilitation is recommended

3.3 Performance Effectiveness Evaluation

The results of the Performance Effectiveness Evaluation are combined with the results of a Performance Area Risk Analysis to determine a Performance Effectiveness Score (PES). The objectives of the Performance Effectiveness Evaluation include:

- Measure the benefit to the performance system versus the cost of the solution
- Include risk factors to help differentiate between similar solutions
- Apply to each performance area that is affected by the candidate solution
- Accounts for emphasis areas identified for the corridor

The Performance Effectiveness Evaluation includes the following steps:

- Estimate the post-solution performance for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight)
- Use the post-solution performance scores to calculate a post-solution level of need for each of the five performance areas
- Compare the pre-solution level of need to the post-solution level of need to determine the reduction in level of need (potential solution benefit) for each of the five performance areas
- Calculate performance area risk weighting factors for each of the five performance areas
- Use the reduction in level of need (benefit) and risk weighting factors to calculate the PES

Post-Solution Performance Estimation

For each performance area, a slightly different approach is used to estimate the post-solution performance. This process is based on the following assumptions:

- Pavement:
  - The International Roughness Index (IRI) rating would decrease (to 30 for replacement or 45 for rehabilitation)
  - The Cracking rating would decrease (to 0 for replacement or rehabilitation)
- Bridge:
  - The structural ratings would increase (+1 for repair, +2 for rehabilitation, or increase to 8 for replacement)
  - The Sufficiency Rating would increase (+10 for repair, +20 for rehabilitation, or increase to 98 for replacement)
- Mobility:
  - Additional lanes would increase the capacity and therefore affect the Mobility Index and associated secondary measures
  - Other improvements (e.g., ramp metering, parallel ramps, variable speed limits) would also increase the capacity (to a lesser extent than additional lanes) and therefore would affect the Mobility Index and associated secondary measures
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the Travel Time Index (TTI) secondary measure
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the Planning Time Index (PTI) secondary measure
  - Changes in the Safety Index (due to crash reductions) would have a direct effect on the Closure Extent secondary measure
- Safety:
  - Crash modification factors were developed that would be applied to estimate the reduction in crashes (for additional information see **Appendix C**)
- Freight:
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the Freight Index and the Truck PTI (TPTI) secondary measure
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the Truck TTI (TTTI) secondary measure
  - Changes in the Safety Index (due to crash reductions) would have a direct effect on the Closure Duration secondary measure

Performance Area Risk Analysis

The Performance Area Risk Analysis is intended to develop a numeric risk weighting factor for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight). This risk analysis addresses other considerations for each performance area that are not directly included in the performance system. A risk weighting factor is calculated for each candidate solution based on the specific characteristics at the solution location. For example, the Pavement Risk Factor is based on factors such as the elevation, daily traffic volumes, and amount of truck traffic. Additional information regarding the Performance Area Risk Factors is included in **Appendix D**.

Following the calculation of the reduction in level of need (benefit) and the Performance Area Risk Factors, these values are used to calculate the PES. In addition, the reduction in level of need in each emphasis area is also included in the PES.

Net Present Value Factor

The benefit (reduction in need) is measured as a one-time benefit. However, different types of solutions will have varying service lives during which the benefits will be obtained. For example, a preservation solution would likely have shorter stream of benefits over time when compared to a modernization or expansion solution. To address the varying lengths of benefit streams, each solution is classified as a 10-year, 20-year, 30-year, or 75-year benefit stream, or the net present value (NPV) factor (F_{NPV}). A 3% discount rate is used to calculate F_{NPV} for each classification of solution. The service lives and respective factors are described below:

- A 10-year service life is generally reflective of a preservation solution; this would include pavement and bridge preservation solutions which would likely have a 10-year stream of benefits; for these solutions, a F_{NPV} of 8.8 is used in the PES calculation
- A 20-year service life is reflective of modernization solutions that generally do not include new infrastructure; these solutions would likely have a 20-year stream of benefits; for these solutions, a F_{NPV} of 15.3 is used in the PES calculation
- A 30-year service life is generally reflective of an expansion solution or a modernization solution that includes new infrastructure; these solutions would likely have a 30-year stream of benefits; for these solutions, a F_{NPV} of 20.2 is used in the PES calculation
- A 75-year service life was used for bridge replacement solutions; for these solutions, a F_{NPV} of 30.6 is used in the PES calculation

Vehicle-Miles Travelled Factor

Another factor in assessing benefits is the number of travelers who would benefit from the implementation of the candidate solution. This factor varies between candidate solutions depending on the length of the solution and the magnitude of daily traffic volumes. Multiplying the solution length by the daily traffic volume results in vehicle-miles travelled (VMT), which provides a measure of the amount of traffic exposure that would receive the benefit of the proposed solution. The VMT is converted to a VMT factor (known as F_{VMT}), which is on a scale between 0 and 5, using the equation below:

$$F_{VMT} = 5 - (5 \times e^{VMT \times -0.0000139})$$

Performance Effectiveness Score

The PES is calculated using the following equation:

PES = ((Sum of all Risk Factored Benefit Scores + Sum of all Risk Factored Emphasis Area Scores) / Cost) x F_{VMT} x F_{NPV}

Where,

Risk Factored Benefit Score = Reduction in Segment-Level Need (benefit) x Performance Area Risk Weighting Factor (calculated for each performance area)

Risk Factored Emphasis Area Score = Reduction in Corridor-Level Need x Performance Area Risk Factors x Emphasis Area Factor (calculated for each emphasis area)

*Cost = estimated cost of candidate solution in millions of dollars (see **Appendix A**)*

F_{VMT} = Factor between 0 and 5 to account for VMT at location of candidate solution based on existing (2014) daily volume and length of solution

F_{NPV} = Factor (ranging from 8.8 to 30.6 as previously described) to address anticipated longevity of service life (and duration of benefits) for each candidate solution

The resulting PES values are shown in **Table 5**. Additional information regarding the calculation of the PES is contained in **Appendix E**.

For candidate solutions with multiple options to address Mobility, Safety, or Freight needs, the PES should be compared to help identify the best performing option. If one option clearly performs better than the other options (e.g., more than twice the PES value and a difference in magnitude of at least 20 points), the other options should be eliminated from further consideration. If multiple options have similar PES values, those options should all be advanced to the prioritization process. On the US 60|US 70|US 191 corridor, the following candidate solutions have options:

- CS191.1 (A, B) – US 191 Elfrida to I-10 Freight Mitigation
- CS60.9 (A, B, C) – US 60 Pinal SPRR UP (No. 0562) Freight Mitigation
- CS60.12 (A, B, C) - US 60 Superior to Miami Mobility and Freight Mitigation MP 227-243

Based on a review of the PES values, the candidate solution options recommended for elimination from further consideration are CS60.9 A and CS60.9B.

Table 5: Performance Effectiveness Scores

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost* ($ million)	Risk Factored Benefit Score					Risk Factored Emphasis Area Scores			Total Factored Benefit Score	F_{VMT}	F_{NPV}	Performance Effectiveness Score
				Pavement	Bridge	Safety	Mobility	Freight	Safety	Mobility	Freight				
191.1A	US 191 Elfrida to I-10 Freight Mitigation: Widen shoulders, realign roadway, replace Cochise RR bridge	59.9-64	$105.6	0.821	7.377	0.000	6.197	0.871	0.018	0.000	0.034	15.319	0.40	15.3	0.9
191.1B	US 191 Elfrida to I-10 Freight Mitigation: Construct passing lanes, realign roadway, replace Cochise RR bridge	59.9-64	$121.5	0.821	7.377	0.000	10.317	0.871	0.018	0.081	0.034	19.520	0.40	15.3	1.0
191.2	US191 Safford Safety Improvements	117-121	$1.4	0.000	0.000	4.195	0.015	0.000	1.188	0.000	0.000	5.398	0.55	15.3	32.2
70.4	US 70 San Carlos Safety Improvements	268-292	$46.1	0.000	0.000	10.141	4.456	0.000	0.889	0.000	0.000	15.487	2.81	15.3	14.4
70.5	US 70 Cutter Safety Improvements	257-260	$5.6	0.000	0.000	3.973	3.794	0.000	0.906	0.000	0.000	8.673	0.55	15.3	13.1
60.6	Pinal Creek Bridge (#36)	249.8	$2.4	0.000	9.718	0.000	0.361	0.000	0.000	0.000	0.000	10.079	0.29	30.6	36.7
60.7	Pinal Creek Bridge (#226)	249.64	$3.1	0.000	10.931	0.000	1.542	0.000	0.000	0.000	0.000	12.472	0.29	30.6	35.2
60.8	US 60 Globe-Miami Safety Improvements	244.5-251	$10.2	0.084	0.000	14.370	2.204	1.004	9.110	0.000	0.015	26.787	2.84	15.3	114.3
60.9	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	253.4-253.8	$1.1	0.000	0.000	0.000	0.000	3.514	0.000	0.000	0.015	3.529	0.30	15.3	14.6
60.10	Queen Creek Bridge (#406)	227.71	$8.8	0.000	12.493	0.238	1.160	0.000	0.051	0.000	0.000	13.942	0.87	30.6	42.2
60.11	Waterfall Canyon Bridge (#328)	229.5	$1.7	0.000	12.413	0.000	0.772	0.000	0.000	0.000	0.000	13.185	0.71	30.6	168.4
60.12A	US 60 Superior to Miami Widen shoulder	227-243	$11.3	0.000	0.000	4.696	8.985	2.454	0.995	0.000	0.061	17.191	4.33	15.3	100.9
60.12B	US 60 Superior to Miami Climbing/ Passing Lanes	227-243	$113.6	0.166	6.373	10.388	129.377	5.527	7.385	1.334	0.108	160.659	4.33	20.2	123.8
60.12C	US 60 Superior to Miami Construct New 4-lane divided	227-243	$157.2	0.849	6.373	13.523	130.769	6.408	7.436	1.407	0.132	166.897	4.33	20.2	93.0
60.13	US 60 Top-of-the-World Safety Improvements	232-234	$1.0	0.000	0.000	5.383	0.002	0.801	1.144	0.000	0.024	7.353	1.11	15.3	125.4
60.14	US 60 Queen Creek Safety Improvements	227-229	$2.7	0.000	0.000	5.488	0.002	0.801	1.165	0.000	0.024	7.480	1.11	15.3	47.2

*: See **Table 6** for total construction costs

3.4 Solution Risk Analysis

Following the calculation of the PES, an additional step is taken to develop a prioritized list of solutions. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of performance failure. **Figure 4** shows the risk matrix used to develop the risk weighting factors.

Figure 4: Risk Matrix

		Severity/Consequence				
		Insignificant	**Minor**	**Significant**	**Major**	**Catastrophic**
Frequency/ Likelihood	**Very Rare**	Low	Low	Low	Moderate	Major
	Rare	Low	Low	Moderate	Major	Major
	Seldom	Low	Moderate	Moderate	Major	Severe
	Common	Moderate	Moderate	Major	Severe	Severe
	Frequent	Moderate	Major	Severe	Severe	Severe

Using the risk matrix in **Figure 4**, numeric values were assigned to each category of frequency and severity. The higher the risk, the higher the numeric factor that was assigned. The risk weight for each area of the matrix was calculated by multiplying the severity factor times the frequency factor. These numeric factors are shown in **Figure 5**.

Figure 5: Numeric Risk Matrix

			Severity/Consequence				
			Insignificant	**Minor**	**Significant**	**Major**	**Catastrophic**
		Weight	1.00	1.10	1.20	1.30	1.40
Frequency/ Likelihood	**Very Rare**	1.00	1.00	1.10	1.20	1.30	1.40
	Rare	1.10	1.10	1.21	1.32	1.43	1.54
	Seldom	1.20	1.20	1.32	1.44	1.56	1.68
	Common	1.30	1.30	1.43	1.56	1.69	1.82
	Frequent	1.40	1.40	1.54	1.68	1.82	1.96

Using the values in **Figure 5**, risk weighting factors were calculated for each of the following four risk categories: low, moderate, major, and severe. These values are simply the average of the values in **Figure 5** that fall within each category. The resulting average risk weighting factors are:

Low	Moderate	Major	Severe
1.14	1.36	1.51	1.78

The risk weighting factors listed above were assigned to the five performance areas as follows:

- Safety = 1.78

  The Safety performance area quantifies the likelihood of fatal or incapacitating crashes; therefore, it was assigned the Severe (1.78) risk weighting factor.

- Bridge = 1.51

  The Bridge performance area focuses on the structural adequacy of the bridges. A failure may result in crashes or traffic being detoured for long periods of time resulting in significant travel time increases; therefore, it was assigned the Major (1.51) risk weighting factor.

- Mobility and Freight = 1.36

  The Mobility and Freight performance areas focus on capacity and congestion. Failure in either of these performance areas would result in increased travel times but would not have significant effect on safety (crashes) that would not already be addressed in the Safety performance area; therefore, they were assigned the Moderate (1.36) risk weighing factor.

- Pavement = 1.14

  The Pavement performance area focuses on the ride quality of the pavement. Failure in this performance area would likely be a spot location that would not dramatically affect drivers beyond what is already captured in the Safety performance area; therefore, it was assigned the Low (1.14) risk weighing factor.

The benefit in each performance area is calculated for each candidate solution as part of the Performance Effectiveness Evaluation. Using this information on benefits and the risk factors listed above, a weighted (based on benefit) solution-level numeric risk factor is calculated for each candidate solution. For example, a solution that has 50% of its benefit in Safety and 50% of its benefit in Mobility has a weighted risk factor of 1.57 (0.50 x 1.78 + 0.50 x 1.36 = 1.57).

3.5 Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score as follows:

Prioritization Score = PES x Weighted Risk Factor x Segment Average Need Score

Where:

PES = Performance Effectiveness Score as shown in ***Table 5***

Weighted Risk Factor = Weighted factor to address risk of not implementing a solution based on the likelihood and severity of the performance failure

Segment Average Need Score = Segment average need score as shown in Working Paper 4

The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process. The prioritized list of candidate solutions is provided in the subsequent section. See Appendix F for additional information on the prioritization process.

4.0 SUMMARY OF CORRIDOR RECOMMENDATIONS

4.1 Prioritized Candidate Solution Recommendations

Table 6 and **Figure 6** show the prioritized candidate solutions recommended for the US 60|US 70|US 191 corridor. Implementation of these solutions is anticipated to improve performance of the corridor. The following observations were noted about the prioritized solutions:

- Most of the anticipated improvements in performance are in the Mobility, Safety, and Freight performance areas
- The highest ranking solutions tended to have overlapping benefits in the Mobility, Safety, and Freight performance areas
- The highest priority solutions address needs in the US 60 Superior to Miami area (MP 227 to MP 243)

4.2 Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations can also be identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor-specific recommendations that are not related to construction or policy. The list below identifies other corridor recommendations for the US 60|US 70|US 191 corridor:

- A Sign Visibility Study in the Safford area along US 191 is recommended to identify locations with potential to improve retroreflectivity. Poor visibility of crossroads in the Safford area is causing a higher level of crashes.
- Road Safety Assessments are recommended in Peridot, Cutter and Globe to identify safety improvements, specifically pedestrian circulation and access needs in Peridot.
- Access Control Studies in Peridot (MP270 – 274) and Globe-Miami (MP 243 – 255) are recommended to identify potential for access consolidation, signage, etc to reduce friction and improve safety.
- Recommend Superior – Globe DCR/Feasibility Study
- Recommend San Carlos Area (MP 268 – 292) Superelevation Study

4.3 Policy and Initiative Recommendations

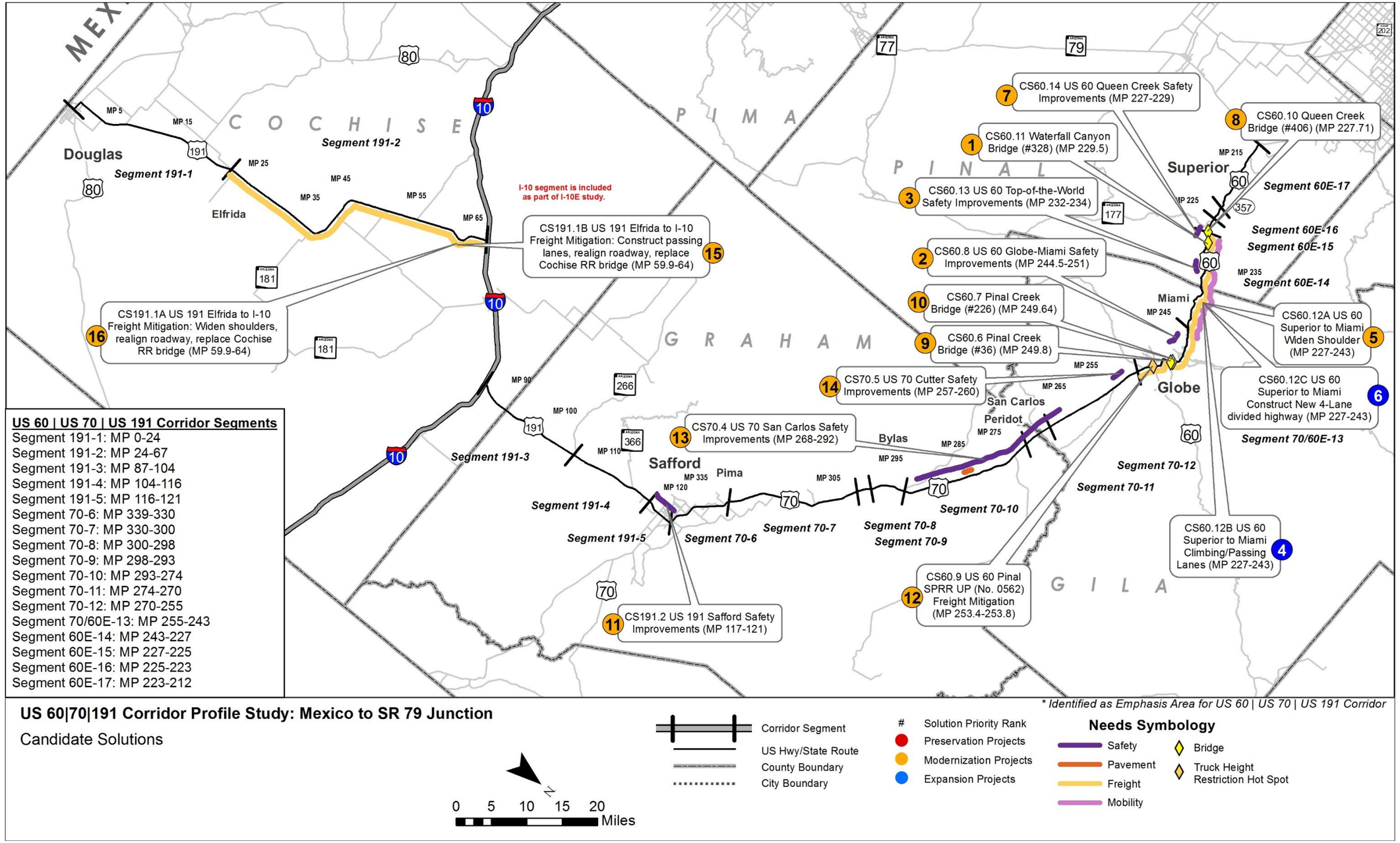
In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through this process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on US 60|US 70|US 191, but across the entire state highway system where the conditions are applicable. The following list, which is in no particular order of priority, was derived from the Round 1, Round 2, and Round 3 CPS:

- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic message signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects
- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects. In pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is required to ensure adequate reflection of safety issues
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network

Table 6: Prioritized Recommended Solutions

Rank	Candidate Solution #	Segment #	Candidate Solution Name	Milepost Location	Estimated Cost ($ million)	Performance Effectiveness Score	Weighted Risk Factor	Segment Need	Prioritization Score	Investment Category	Solution Need Reduction Notes				
											Pavement	Bridge	Mobility	Safety	Freight
1	60.11	60-14	Waterfall Canyon Bridge (#328)	229.5	$1.7	168.4	1.501	2.00	506	Modernization	1%	100%	0%	0%	0%
2	60.8	70|60-13	US 60 Globe-Miami Safety Improvements	244.5-251	$10.2	114.3	1.728	2.23	440	Modernization	0%	0%	47%	48%	0%
3	60.13	60-14	US 60 Top-of-the-World Safety Improvements	232-234	$1.0	125.4	1.734	2.00	435	Modernization	0%	0%	0%	12%	0%
4	60.12B	60-14	US 60 Superior to Miami Climbing/Passing Lanes	227-243	$113.6	123.8	1.413	2.00	350	Expansion	20%	0%	91%	24%	11%
5	60.12A	60-14	US 60 Superior to Miami Widen Shoulder	227-243	$11.3	100.9	1.500	2.00	303	Modernization	0%	0%	6%	53%	5%
6	60.12C	60-14	US 60 Superior to Miami Four-Lane Divided	227-243	$157.2	93.0	1.418	2.00	264	Expansion	50%	0%	92%	31%	13%
7	60.14	60-14	US 60 Queen Creek Safety Improvements	227-229	$2.7	47.2	1.735	2.00	164	Modernization	0%	0%	0%	2%	0%
8	60.10	60-14	Queen Creek Bridge (#406)	227.71	$8.8	42.2	1.503	2.00	127	Modernization	1%	100%	0%	0%	0%
9	60.6	70|60-13	Pinal Creek Bridge (#36)	249.8	$2.4	36.7	1.505	2.23	123	Modernization	1%	100%	0%	0%	0%
10	60.7	70|60-13	Pinal Creek Bridge (#226)	249.64	$3.1	35.2	1.491	2.23	117	Modernization	1%	100%	0%	0%	0%
11	191.2	191-5	US191 Safford Safety Improvements	117-121	$1.4	32.2	1.779	2.00	114	Modernization	0%	0%	0%	32%	0%
12	60.9	70|60-13	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	253.4-253.8	$1.1	14.6	1.360	2.23	44	Modernization	1%	0%	0%	0%	26%
13	70.4	70-10	US 70 San Carlos Safety Improvements	268-292	$46.1	14.4	1.659	1.40	34	Modernization	0%	0%	33%	32%	0%
14	70.5	70-12	US 70 Cutter Safety Improvements	257-260	$5.6	13.1	1.596	1.31	27	Modernization	0%	0%	65%	36%	0%
15	191.1B	191-2	US 191 Elfrida to I-10 Freight Mitigation: Construct passing lanes, realign roadway, replace Cochise RR bridge	59.9-64	$121.5	1.0	1.408	1.38	2	Modernization	9%	0%	9%	0%	3%
16	191.1A	191-2	US 191 Elfrida to I-10 Freight Mitigation: Widen shoulders, realign roadway, replace Cochise RR bridge	59.9-64	$105.6	0.9	1.421	1.38	2	Modernization	9%	0%	55%	0%	3%

Figure 6: Prioritized Recommended Solutions



4.4 Next Steps

The candidate solutions recommended in this study are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the US 60|US 70|US 191corridor will be considered along with other candidate projects in the ADOT statewide programming process.

It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendations from such studies are still relevant to addressing the ultimate corridor objectives.

The concluding step in the CPS will be to produce a final report that summarizes Working Papers 1 through 6.

Upon completion of all three CPS rounds, the results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.

APPENDIX A: CANDIDATE SOLUTION COST ESTIMATES

NEW Solution #	Candidate #	Location #	Name	Investment Category Preservation [P] Modernization [M] Expansion [E]	Option	Scope	BMP	EMP	Unit	Quantity	Unit Cost	Construction Cost	Factored Construction Unit Cost	Preliminary Engineering Cost (3%)	Design Cost (10%)	Right-of-Way Cost (assuming $12/sf)	Total Cost
CS191.1A	CS191.1A	L4	US 191 Elfrida to I-10 Freight Mitigation: Widen Shoulders	M	-	Realign Roadway	59.9	64.2	mi	4.3	$ 5,920,000.00	$25,456,000	$56,003,200	$1,680,000	$5,600,000	$40,867,200	$104,150,400
						Replace Cochise RR Bridge	59.9	64.2	SF	3250	$ 180.00	$585,000	$1,287,000	$40,000	$130,000	$0	$1,457,000
						Solution Total						**$26,041,000**	**$57,290,200**	**$1,720,000**	**$5,730,000**	**$40,867,200**	**$105,607,400**
CS191.1B	CS191.1B	L4	US 191 Elfrida to I-10 Freight Mitigation: Construct Passing Lanes	M	-	Construct Passing Lanes (NB and SB)	59.9	64.2	mi	4.3	$ 1,500,000.00	$6,450,000	$14,190,000	$400,000	$1,400,000	$0	$15,990,000
						Realign Roadway	59.9	64.2	mi	4.3	$ 5,920,000.00	$25,456,000	$56,003,200	$1,680,096	$5,600,320	$40,867,200	$104,150,816
						Replace Cochise RR Bridge	59.9	64.2	SF	3250	$ 180.00	$585,000	$1,287,000	$0	$100,000	$0	$1,387,000
						Solution Total						**$32,491,000**	**$71,480,200**	**$2,080,096**	**$7,100,320**	**$40,867,200**	**$121,527,816**
CS191.2	CS191.2A	L10	US191/Armory Road Intersection Safety Improvements	M	-	Install Warning Signs with Beacons	118	118	each	1	$ 15,000.00	$15,000	$33,000	$990	$3,300	$0	$37,290
						Improve Signal Visibility	118	118	each	1	$ 35,000.00	$35,000	$77,000	$2,310	$7,700	$0	$87,010
						Solution Total						**$50,000**	**$110,000**	**$3,300**	**$11,000**	**$0**	**$124,300**
	CS191.2B	L10	US191/Discovery Park Intersection Safety Improvements	M	-	Improve Signal Visibility	119	119	each	1	$ 35,000.00	$35,000	$77,000	$2,310	$7,700	$0	$87,010
						Install Speed Feedback Signs	119	119	each	1	$ 25,000.00	$25,000	$55,000	$1,650	$5,500	**$0**	$62,150
						Solution Total						**$60,000**	**$132,000**	**$3,960**	**$13,200**	**$0**	**$149,160**
	CS191.2C	L10	US191/Lone Star Intersection Safety Improvements	M	-	Install Traffic Signal	119.5	119.5	each	1	$ 150,000.00	$150,000	$330,000	$9,900	$33,000	$0	$372,900
						Install Lighting	119.5	119.5	mi	1	$ 270,000.00	$270,000	$594,000	$17,820	$59,400	$0	$671,220
						Install Intersection Warning Signs with Beacons	119.5	119.5	each	1	$ 15,000.00	$15,000	$33,000	$990	$3,300	$0	$37,290
						Solution Total						**$435,000**	**$957,000**	**$28,710**	**$95,700**	**$0**	**$1,081,410**
	CS191.2D	L10	US191/16th Street Intersection Safety Improvements	M	-	Install Warning Signs with Beacons	120.5	120.5	each	1	$ 15,000.00	$15,000	$33,000	$990	$3,300	$0	$37,290
						Solution Total						**$15,000**	**$33,000**	**$990**	**$3,300**	**$0**	**$37,290**

NEW Solution #	Candidate #	Location #	Name	Investment Category Preservation [P] Modernization [M] Expansion [E]	Option	Scope	BMP	EMP	Unit	Quantity	Unit Cost	Construction Cost	Factored Construction Unit Cost	Preliminary Engineering Cost (3%)	Design Cost (10%)	Right-of-Way Cost (assuming $12/sf)	Total Cost
CS70.4-1	CS70.4A	L15	US 70 San Carlos Safety Improvements	M	-	Install High-Visibility Edge Line Striping	274	292	mile	18	$ 21,600.00	$388,800	$855,360	$25,661	$85,540	$0	$966,561
						Install High-Visibility Signage	274	292	each	1	$ 5,400.00	$5,400	$11,880	$356	$1,190	$0	$13,426
						Install Centerline Rumble Strip	274	292	mile	18	$ 2,800.00	$50,400	$110,880	$3,326	$11,090	$0	$125,296
						Install Rumble Strip	274	292	mi	10	$ 11,000.00	$110,000	$242,000	$7,260	$24,200	$0	$273,460
						Widen Shoulders	274	292	mi	10	$ 256,000.00	$2,560,000	$5,632,000	$168,960	$563,200	$0	$6,364,160
						Install Safety Edge	274	292	mi	10	$ 80,000.00	$800,000	$1,760,000	$52,800	$176,000	$0	$1,988,800
						Solution Total						**$3,914,600**	**$8,612,120**	**$258,364**	**$861,220**	**$0**	**$9,731,704**
	CS70.4D	L15	US 70: Warning Signs with Beacons at Curves and Speed Feedback Signs (MP 292)	M	-	Install Warning Signs with Beacons (MP 292)	291	293	each	1	$ 15,000.00	$15,000	$33,000	$990	$3,300	$0	$37,290
						Install Speed Feedback Signs	291	293	each	1	$ 25,000.00	$25,000	$55,000	$1,650	$5,500		$62,150
						Solution Total						**$40,000**	**$88,000**	**$2,640**	**$8,800**	**$0**	**$99,440**
	CS70.4E	L15	US 70: Warning Signs with Beacons at Curves and Speed Feedback Signs, (MP 280)	M	-	Install Warning Signs with Beacon (MP 280)	279	281	each	1	$ 15,000.00	$15,000	$33,000	$990	$3,300	$0	$37,290
						Install Speed Feedback Signs	279	281	each	1	$ 25,000.00	$25,000	$55,000	$1,650	$5,500		$62,150
						Solution Total						**$40,000**	**$88,000**	**$2,640**	**$8,800**	**$0**	**$99,440**
	CS70.4F	L15	US 70: Warning Signs with Beacons at Curves and Speed Feedback Signs, (MP 278.5)	M	-	Install Warning Signs with Beacon (MP 278.5)	277.5	279.5	each	1	$ 15,000.00	$15,000	$33,000	$990	$3,300	$0	$37,290
						Install Speed Feedback Signs	277.5	279.5	each	1	$ 25,000.00	$25,000	$55,000	$1,650	$5,500		$62,150
						Solution Total						**$40,000**	**$88,000**	**$2,640**	**$8,800**	**$0**	**$99,440**
	CS70.4M	L15	US 70: Peridot WB pullout	M	-	Formalize Pullouts (signage, ROW for pullouts) (WB MP 274.5)	275.5	274.5	each	1	$ 7,400.00	$7,400	$16,280	$488	$1,630	$0	$18,398
						Solution Total						**$7,400**	**$16,280**	**$488**	**$1,630**	**$0**	**$18,398**
	CS70.4N	L15	US 70: Peridot EB pullout	M	-	Formalize Pullouts (signage, ROW for pullouts) (EB MP 279)	278	279	each	1	$ 27,400.00	$27,400	$60,280	$1,808	$6,030	$0	$68,118
						Solution Total						**$27,400**	**$60,280**	**$1,808**	**$6,030**	**$0**	**$68,118**
	CS70.4O	L15	US 70: Ft Thomas EB pullout	M	-	Formalize Pullouts (signage, ROW for pullouts) (EB MP 289)	288	289	each	1	$ 77,900.00	$77,900	$171,380	$5,141	$17,140	$0	$193,661
						Solution Total						**$77,900**	**$171,380**	**$5,141**	**$17,140**	**$0**	**$193,661**
	CS70.4P	L15	US 70: Ft Thomas WB pullout	M	-	Formalize Pullouts (signage, ROW for pullouts) (WB 292)	293	292	each	1	$ 77,900.00	$77,900	$171,380	$5,141	$17,140	$0	$193,661
						Solution Total						**$77,900**	**$171,380**	**$5,141**	**$17,140**	**$0**	**$193,661**
CS70.4-2	CS70.4B	L15	US 70 San Carlos Safety Improvements	M	-	Install High-Visibility Edge Line Striping	270	274	mi	4	$ 21,600.00	$86,400	$190,080	$5,702	$19,010	$0	$214,792
						Install High-Visibility Signage	270	274	each	1	$ 5,400.00	$5,400	$11,880	$356	$1,190	$0	$13,426
						Install Centerline Rumble Strip	270	274	mi	4	$ 2,800.00	$11,200	$24,640	$739	$2,460	$0	$27,839
						Widen Shoulders	270	274	mi	4	$ 256,000.00	$1,024,000	$2,252,800	$67,584	$225,280	$0	$2,545,664
						Install Safety Edge	270	274	mi	4	$ 80,000.00	$320,000	$704,000	$21,120	$70,400	$0	$795,520
						Install Rumble Strip	270	274	mi	4	$ 11,000.00	$44,000	$96,800	$2,904	$9,680	$0	$109,384
						Solution Total						**$1,491,000**	**$3,280,200**	**$98,406**	**$328,020**	**$0**	**$3,706,626**
	CS70.4G	L15	US 70: Warning Signs and Speed Feedback Signs entering high pedestrian area (WB MP 273)	M	-	Install Warning Signs (MP 273)	273	272	each	1	$ 2,500.00	$2,500	$5,500	$165	$550	$0	$6,215
						Install Speed Feedback Signs	273	272	each	1	$ 25,000.00	$25,000	$55,000	$1,650	$5,500	$0	$62,150
						Solution Total						**$27,500**	**$60,500**	**$1,815**	**$6,050**	**$0**	**$68,365**

NEW Solution #	Candidate #	Location #	Name	Investment Category Preservation [P] Modernization [M] Expansion [E]	Option	Scope	BMP	EMP	Unit	Quantity	Unit Cost	Construction Cost	Factored Construction Unit Cost	Preliminary Engineering Cost (3%)	Design Cost (10%)	Right-of-Way Cost (assuming $12/sf)	Total Cost
CS70.4-3	CS70.4C	L15	US 70 San Carlos Safety Improvements	M	-	Install High-Visibility Edge Line Striping	268	270	mi	2	$ 21,600.00	$43,200	$95,040	$2,851	$9,500	$0	$107,391
						Install High-Visibility Signage	268	270	mi	2	$ 5,400.00	$10,800	$23,760	$713	$2,380	$0	$26,853
						Install Centerline Rumble Strip	268	270	mi	2	$ 2,800.00	$5,600	$12,320	$370	$1,230	$0	$13,920
						Widen Shoulders	268	270	mi	2	$ 256,000.00	$512,000	$1,126,400	$33,792	$112,640	$0	$1,272,832
						Install Safety Edge	268	270	mi	2	$ 80,000.00	$160,000	$352,000	$10,560	$35,200	$0	$397,760
						Install Rumble Strip	268	270	mi	2	$ 11,000.00	$22,000	$48,400	$1,452	$4,840	$0	$54,692
						Solution Total						**$753,600**	**$1,657,920**	**$49,738**	**$165,790**	**$0**	**$1,873,448**
	CS70.4H	L15	US 70: Warning Signs and Speed Feedback Signs entering high pedestrian area (EB 269)	M	-	Install Warning Signs (EB 269)	268	269	each	1	$ 2,500.00	$2,500	$5,500	$165	$550	$0	$6,215
						Install Speed Feedback Signs	268	269	each	1	$ 25,000.00	$25,000	$55,000	$1,650	$5,500	$0	$62,150
						Solution Total						**$27,500**	**$60,500**	**$1,815**	**$6,050**	**$0**	**$68,365**
CS70.4-4	CS70.4I	L15	US 70: EB Passing Lane	M	-	Construct Climbing Lane (EB)	262	264	mi	2	$ 1,500,000.00	$3,000,000	$6,600,000	$198,000	$660,000	$0	$7,458,000
						Solution Total						**$3,000,000**	**$6,600,000**	**$198,000**	**$660,000**	**$0**	**$7,458,000**
CS70.4-7	CS70.4L	L15	US 70: WB Passing Lane	M	-	Construct Passing Lane (WB)	282	288	mi	6	$ 1,500,000.00	$9,000,000	$19,800,000	$594,000	$1,980,000	$0	$22,374,000
						Solution Total						**$9,000,000**	**$19,800,000**	**$594,000**	**$1,980,000**	**$0**	**$22,374,000**
CS70.5	CS70.5A	L16	US 70 Cutter Safety Improvements	M	-	Widen Shoulders	257	260	mi	3	$ 256,000.00	$768,000	$1,689,600	$50,688	$168,960	$0	$1,909,248
						Install Rumble Strip	257	260	mi	3	$ 11,000.00	$33,000	$72,600	$2,178	$7,260	$0	$82,038
						Install Safety Edge	257	260	mi	3	$ 80,000.00	$240,000	$528,000	$15,840	$52,800	$0	$596,640
						Solution Total						**$1,041,000**	**$2,290,200**	**$68,706**	**$229,020**	**$0**	**$2,587,926**
	CS70.5B	L16	US 70 Lighting	M	-	Install Lighting	258	260	mi	2	$ 540,000.00	$1,080,000	$2,376,000	$71,280	$237,600	$0	$2,684,880
						Solution Total						**$1,080,000**	**$2,376,000**	**$71,280**	**$237,600**	**$0**	**$2,684,880**
	CS70.5C	L16	US 70/BIA Route 6 Intersection Safety Improvements	M	-	Install Warning Signs (EB MP 258 and WB MP 259)	257.5	260.0	each	2	$ 5,000.00	$10,000	$22,000	$660	$2,200	$0	$24,860
						Solution Total						**$10,000**	**$22,000**	**$660**	**$2,200**	**$0**	**$24,860**
	CS70.5D	L16	US 70 Center Turn Lane	M	-	Install Center Turn Lane	258	260	mi	2	$ 450,000.00	$900,000	$1,980,000	$59,400	$198,000	$0	$2,237,400
						Solution Total						**$900,000**	**$1,980,000**	**$59,400**	**$198,000**	**$0**	**$2,237,400**
CS60.6	CS60.15	L19	US 60 Pinal Creek Bridge (No. 36)	M	-	Replace Bridge	249.8	249.8	SF	7558	$ 125.00	$944,750	$2,078,450	$62,354	$207,850	$0	$2,348,654
						Solution Total						**$944,750**	**$2,078,450**	**$62,354**	**$207,850**	**$0**	**$2,348,654**
CS60.7	CS60.16	L20	US 60 Pinal Creek Bridge (No. 266)	M	-	Replace Bridge	249.6	249.6	SF	9963	$ 125.00	$1,245,375	$2,739,825	$82,195	$273,980	$0	$3,096,000
						Solution Total						**$1,245,375**	**$2,739,825**	**$82,195**	**$273,980**	**$0**	**$3,096,000**
CS60.8	CS60.8B	L22	US 60 Globe-Miami Lighting	M	-	Install Lighting	244.5	250.0	mi	5.5	$ 540,000.00	$2,970,000	$6,534,000	$196,020	$653,400	$0	$7,383,420
						Solution Total						**$2,970,000**	**$6,534,000**	**$196,020**	**$653,400**	**$0**	**$7,383,420**
	CS60.8C	L22	US 60 Globe-Miami Speed Feedback Signs	M	-	Install Speed Feedback Signs	246	250	each	1	$ 25,000.00	$25,000	$55,000	$1,650	$5,500	$0	$62,150
						Solution Total						**$25,000**	**$55,000**	**$1,650**	**$5,500**	**$0**	**$62,150**
	CS60.8D	L22	US 60/188 Intersection Safety Improvements	M	-	Install Warning Signs with Beacons	246.5	247.5	each	1	$ 15,000.00	$15,000	$33,000	$990	$3,300	$0	$37,290
						Solution Total						**$15,000**	**$33,000**	**$990**	**$3,300**	**$0**	**$37,290**
	CS60.8E	L22	US 60 Globe-Miami Pavement Rehabilitation	M	-	Rehabilitate Pavement	249	251	mi	2	$ 553,000.00	$1,106,000	$2,433,200	$72,996	$243,320	$0	$2,749,516
						Solution Total						**$1,106,000**	**$2,433,200**	**$72,996**	**$243,320**	**$0**	**$2,749,516**

NEW Solution #	Candidate #	Location #	Name	Investment Category Preservation [P] Modernization [M] Expansion [E]	Option	Scope	BMP	EMP	Unit	Quantity	Unit Cost	Construction Cost	Factored Construction Unit Cost	Preliminary Engineering Cost (3%)	Design Cost (10%)	Right-of-Way Cost (assuming $12/sf)	Total Cost
CS60.9	CS60.9	L24	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	M	-	Re-profile Roadway	253.4	253.8	mi	0.4	$ 974,500.00	$408,699	$899,139	$26,974	$89,910	$0	$1,016,023
						Solution Total						**$408,699**	**$899,139**	**$26,974**	**$89,910**	**$0**	**$1,016,023**
CS60.10	CS60.17	L27	US 60 Queen Creek Bridge (No. 406)	M	-	Replace Bridge	227.7	227.7	SF	19618	$ 180.00	$3,531,240	$7,768,728	$233,062	$776,870	$0	$8,778,660
						Solution Total						**$3,531,240**	**$7,768,728**	**$233,062**	**$776,870**	**$0**	**$8,778,660**
CS60.11	CS60.18	L28	US 60 Waterfall Canyon Bridge (No. 328)	M		Replace Bridge	229.5	229.5	SF	4176	$ 160.00	$668,160	$1,469,952	$44,099	$147,000	$0	$1,661,051
						Solution Total						**$668,160**	**$1,469,952**	**$44,099**	**$147,000**	**$0**	**$1,661,051**
CS60.12A	CS60.12A	L30/L32	US 60 Superior to Miami Widen Shoulder	M	-	Widen Shoulders	227	243	mi	3	$ 256,000.00	$727,661	$1,600,853	$48,026	$160,090	$0	$1,808,969
						Install Rock-Fall Mitigation	227	243	mi	3	$ 1,320,000.00	$3,752,000	$8,254,400	$247,632	$825,440	$0	$9,327,472
						Solution Total						**$4,479,661**	**$9,855,253**	**$295,658**	**$985,530**	**$0**	**$11,136,441**
	CS60.12B	L30/L32	US 60 Superior to Miami Weather Warning	M		Install Dynamic Weather Warning Beacons	227	243	each	1	$ 40,000.00	$40,000	$88,000	$2,640	$8,800	$0	$99,440
						Solution Total						**$40,000**	**$88,000**	**$2,640**	**$8,800**	**$0**	**$99,440**
CS60.12B	CS60.12C	L30/L32	US 60 Superior to Miami Climbing/Passing Lanes	M	-	Construct Passing Lanes (EB 227-227.9, 230.4–232.6), WB (236.4–236.6, 238.1–239.5)	227	243	mi	4.7	$ 3,000,000.00	$14,100,000	$31,020,000	$930,600	$3,102,000	$0	$35,052,600
						Widen to 5-Lane Section	234.20	236.40	mi	2.20	$ 1,350,000.00	$2,970,000	$6,534,000	$196,020	$653,400	$6,969,600	$14,353,020
						Bridges (2 - Replace)	227	243	SF	23794	$ 180.00	$4,282,920	$9,422,424	$282,673	$942,240	$0	$10,647,337
						Bridges (2 - Widen)	227	243	SF	2421	$ 160.00	$387,360	$852,192	$25,566	$85,220	$0	$962,978
						Install Rock-Fall Mitigation	227	243	mi	16	$ 1,320,000.00	$21,120,000	$46,464,000	$1,393,920	$4,646,400	$0	$52,504,320
						Solution Total						**$42,860,280**	**$94,292,616**	**$2,828,778**	**$9,429,260**	**$6,969,600**	**$113,520,254**
CS60.12C	CS60.12D	L30/L32	US 60 Superior to Miami Construct New 4-lane divided	M	-	Construct New 4-Lane divided	227	243	mi	16	$ 3,000,000.00	$48,000,000	$105,600,000	$3,168,000	$10,560,000	$25,344,000	$144,672,000
						Bridges (4)	227	243	SF	31312	$ 160.00	$5,009,856	$11,021,683	$330,650	$1,102,170	$0	$12,454,504
						Solution Total						**$53,009,856**	**$116,621,683**	**$3,498,650**	**$11,662,170**	**$25,344,000**	**$157,126,504**
CS60.13	CS60.13	L31	US 60 Top-of-the-World Safety Improvements	M	-	Install Warning Signs	232	234	each	1	$ 2,500.00	$2,500	$5,500	$165	$550	$0	$6,215
						Install Speed Feedback Signs	232	234	each	1	$ 25,000.00	$25,000	$55,000	$1,650	$5,500	$0	$62,150
						Install High Visibility Edge Line Striping	232	234	mi	2	$ 21,600.00	$43,200	$95,040	$2,851	$9,500	$0	$107,391
						Improve Sign Visibility	232	234	each	1	$ 5,200.00	$5,200	$11,440	$343	$1,140	$0	$12,923
						Install Centerline Rumble Strip	232	234	mi	2	$ 2,800.00	$5,600	$12,320	$370	$1,230	$0	$13,920
						Solution Total						**$81,500**	**$179,300**	**$5,379**	**$17,920**	**$0**	**$202,599**
CS60.14	CS60.14A	L31	US 60 Queen Creek Safety Improvements	M	-	Widen Shoulders	227	229	mi	1.6	$ 256,000.00	$409,600	$901,120	$27,034	$90,110	$0	$1,018,264
						Install Rumble Strip	227	229	mi	1.6	$ 11,000.00	$17,600	$38,720	$1,162	$3,870	$0	$43,752
						Install Safety Edge	227	229	mi	1.6	$ 80,000.00	$128,000	$281,600	$8,448	$28,160	$0	$318,208
						Install Warning Signs	227	229	each	1	$ 2,500.00	$2,500	$5,500	$165	$550	$0	$6,215
						Install Speed Feedback Signs	227	229	each	2.0	$ 25,000.00	$50,000	$110,000	$3,300	$11,000	$0	$124,300
						Install High Visibility Edge Line Striping	227	229	mi	2.0	$ 10,800.00	$21,600	$47,520	$1,426	$4,750	$0	$53,696
						Improve Sign Visibility	227	229	each	1	$ 5,200.00	$5,200	$11,440	$343	$1,140	$0	$12,923
						Install Centerline Rumble Strip	227	229	mi	2	$ 2,800.00	$5,600	$12,320	$370	$1,230	$0	$13,920
						Solution Total						**$640,100**	**$1,408,220**	**$42,247**	**$140,810**	**$0**	**$1,591,277**
	CS60.14B	L31	US 60 Queen Creek EB Guardrail	M	-	Install Guardrail EB	227	229	mi	1.6	$ 130,000.00	$208,000	$457,600	$13,728	$45,760	$0	$517,088
						Solution Total						**$208,000**	**$457,600**	**$13,728**	**$45,760**	**$0**	**$517,088**
	CS60.14C	L31	US 60 Queen Creek WB Guardrail	M	-	Install Guardrail WB	227	229	mi	1.6	$ 130,000.00	$208,000	$457,600	$13,728	$45,760	$0	$517,088
						Solution Total						**$208,000**	**$457,600**	**$13,728**	**$45,760**	**$0**	**$517,088**

APPENDIX B: LIFE-CYCLE COST ANALYSIS

Pinal Creek Bridge (#0036) / ROUTE US60 / MP 249.80

Bridge Information	
Bridge Deck Area (A225)	7558 SF
Year Built (N27)	1920
Exp Service Life	75 YR
Total Bridge Length (N49)	106 LF
Number of Spans (N45+N46)	6
Skew Angle (N34)	41 DEG
Average Elevation	3454.30 FT
Max Pier Height	16.00 FT
* Amount of Widening for Bridge	0 FT
Revised Deck Area (Bridge Replace)	7558 FT
**Scour Critical Rating (N113)	7

Deterioration Slope

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	0.000000x	0.000x	#DIV/0!
Superstr	y =	-0.000555x	-0.203x	4.94
Deck	y =	-0.000555x	-0.203x	4.94

**Input 0 if no widening. Input should include widening on both sides of bridge if applicable.

**If scour critical rating is 3 or lower, Option 2 should consider the implementation of scour countermeasures.

Notes:

1. Widening is intended only to correct lane and/or shoulder width deficiencies. It is not intended for adding traffic capacity (i.e. adding general purpose lanes).

Cost Multipliers		
Elevation > 4000ft	3454	1.00
Pier Height > 30ft	16	1.00
Length to # span ratio	17.67	1.25
Skew > 30degrees	41.00	1.10
Project Cost Multiplier	All Options	2.20

L to # Span Multiplier

L/ # Span Ratio	Multiplier
=>100	1.00
=>60	1.10
<60	1.25

Skew Multiplier

Skew	Multiplier
<30	1.00
=>30	1.10

Adjusted Bridge Replace Cost	
Base Bridge Replacement Cost (Per SF)	$125.00
Bridge Replacement Cost w/ Multipliers (Per SF)	$171.88

Elevation Multiplier

Elev	Multiplier
<4000	1.00
=>4000	1.25

Pier H Multiplier

Pier H	Multiplier
<30	1.00
=>30	1.10

User input cell

Only manipulate cell value after consulting with team

Bridge History (Inspections/As-builts)

Description	Category	Year
Original bridge was built in 1920 (WPA-127)		
Underdeck has spalls with exposed rebars totalling appx 10sf. Rebar section loss appx 10% to 25%.		
Several underdeck delamination totalling appx 190sf.		
This is a concrete slab bridge so deck is the superstructure.		
Abutments have a diagonal crack. Piers have several hairline cracks.		
No repairs requested in the bridge inspection reports since 2004. No rehab work done.		

Replace / Rehab / Repair Information

BRIDGE DECK

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Deck)	Full Deck Replacement	$85.94	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	$5.00	10	+ 1
Repair (Deck)	Patch Spalls / Seal Cracks	$3.00	See Deterioration Slope	+ 0
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 0
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 0

SUPERSTRUCTURE - STEEL

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	$85.94	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	$42.97	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	$5.00	See Deterioration Slope	+ 1

SUPERSTRUCTURE - CONCRETE

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	$85.94	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	$42.97	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

SUBSTRUCTURE - STRUCTURAL

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	$85.94	75	Rating = 8
Rehab (Substr)	Replace Structural Component	$42.97	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1

SUBSTRUCTURE - SCOUR

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	$42.97	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

Notes:

1. Individual replacements assume 50% of total bridge replacement costs

2. Individual rehabs (in cells that are not highlighted) assume 25% of total bridge replacement costs

3. When superstructure replacement is selected, either deck replacement or deck rehab should be selected as well.

Pinal Creek Bridge (#00266) / ROUTE US60 / MP 249.64

Bridge Information	
Bridge Deck Area (A225)	9963 SF
Year Built (N27)	1942
Exp Service Life	75 YR
Total Bridge Length (N49)	135 LF
Number of Spans (N45+N46)	7
Skew Angle (N34)	40 DEG
Average Elevation	3443.00 FT
Max Pier Height	15.13 FT
* Amount of Widening for Bridge	0 FT
Revised Deck Area (Bridge Replace)	9963 FT
**Scour Critical Rating (N113)	7

Deterioration Slope

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000355x	-0.130x	7.72
Superstr	y =	-0.000555x	-0.203x	4.94
Deck	y =	-0.000355x	-0.130x	7.72

*Input 0 if no widening. Input should include widening on both sides of bridge if applicable.

**If scour critical rating is 3 or lower, Option 2 should consider the implementation of scour countermeasures.

Notes:

1. Widening is intended only to correct lane and/or shoulder width deficiencies. It is not intended for adding traffic capacity (i.e. adding general purpose lanes).

Cost Multipliers		
Elevation > 4000ft	3443	1.00
Pier Height > 30ft	15	1.00
Length to # span ratio	19.29	1.25
Skew > 30degrees	40.00	1.10
Project Cost Multiplier	All Options	2.20

L to # Span Multiplier

L/ # Span Ratio	Multiplier
=>100	1.00
=>60	1.10
<60	1.25

Skew Multiplier

Skew	Multiplier
<30	1.00
=>30	1.10

Adjusted Bridge Replace Cost	
Base Bridge Replacement Cost (Per SF)	$125.00
Bridge Replacement Cost w/ Multipliers (Per SF)	$171.88

Elevation Multiplier

Elev	Multiplier
<4000	1.00
=>4000	1.25

Pier H Multiplier

Pier H	Multiplier
<30	1.00
=>30	1.10

User input cell

Only manipulate cell value after consulting with team

Bridge History (Inspections/As-builts)

Description	Category	Year
Original bridge was built in 1942 (FA-91(C)).		
Underdeck has several spalls with exposed rebars totalling. Rebar section loss is appx 10%.		
This is a concrete slab bridge so deck is the superstructure.		
Abutments have a diagonal crack. Piers have several hairline cracks.		
One repair in 2008 to remove existing AC, seal deck and overlay was recommended. This repair could not be verified. No rehab work done.		

Replace / Rehab / Repair Information

BRIDGE DECK

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Deck)	Full Deck Replacement	$85.94	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	$5.00	10	+ 1
Repair (Deck)	Patch Spalls / Seal Cracks	$3.00	See Deterioration Slope	+ 0
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 0
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 0

SUPERSTRUCTURE - STEEL

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	$85.94	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	$42.97	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	$5.00	See Deterioration Slope	+ 1

SUPERSTRUCTURE - CONCRETE

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	$85.94	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	$42.97	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

SUBSTRUCTURE - STRUCTURAL

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	$85.94	75	Rating = 8
Rehab (Substr)	Replace Structural Component	$42.97	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1

SUBSTRUCTURE - SCOUR

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	$42.97	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

Notes:

1. Individual replacements assume 50% of total bridge replacement costs

2. Individual rehabs (in cells that are not highlighted) assume 25% of total bridge replacement costs

3. When superstructure replacement is selected, either deck replacement or deck rehab should be selected as well.

Waterfall Canyon (#0328) / ROUTE US60 / MP 229.50

Bridge Information	
Bridge Deck Area (A225)	4176 SF
Year Built (N27)	1929
Exp Service Life	75 YR
Total Bridge Length (N49)	96 LF
Number of Spans (N45+N46)	4
Skew Angle (N34)	0 DEG
Average Elevation	3703.14 FT
Max Pier Height	20.90 FT
* Amount of Widening for Bridge	0 FT
Revised Deck Area (Bridge Replace)	4176 FT
**Scour Critical Rating (N113)	N

Deterioration Slope

Item	Deterioration Line Equation			Year Drop
	Slope =	Days	Years	
Substr	y =	-0.000601x	-0.219x	4.56
Superstr	y =	-0.000300x	-0.110x	9.13
Deck	y =	0.000000x	0.000x	#DIV/0!

*Input 0 if no widening. Input should include widening on both sides of bridge if applicable.

**If scour critical rating is 3 or lower, Option 2 should consider the implementation of scour countermeasures.

Notes:

1. Widening is intended only to correct lane and/or shoulder width deficiencies. It is not intended for adding traffic capacity (i.e. adding general purpose lanes).

Cost Multipliers		
Elevation > 4000ft	3703	1.00
Pier Height > 30ft	21	1.00
Length to # span ratio	24.00	1.25
Skew > 30degrees	0.00	1.00
Project Cost Multiplier	All Options	2.20

L to # Span Multiplier

L/ # Span Ratio	Multiplier
=>100	1.00
=>60	1.10
<60	1.25

Skew Multiplier

Skew	Multiplier
<30	1.00
=>30	1.10

Adjusted Bridge Replace Cost	
Base Bridge Replacement Cost (Per SF)	$125.00
Bridge Replacement Cost w/ Multipliers (Per SF)	$156.25

Elevation Multiplier

Elev	Multiplier
<4000	1.00
=>4000	1.25

Pier H Multiplier

Pier H	Multiplier
<30	1.00
=>30	1.10

User input cell

Only manipulate cell value after consulting with team

Bridge History (Inspections/As-builts)

Description	Category	Year
Original bridge was built in 1929 (AFE-666(7)).		
Latest deck inspection indicates that the deack wearing surface is in good condition.		
cracks.		
Girders exhibit scalling and small spalls with exposed steel reinforcing that bearing area near the piers.		
Several concrete spalls with exposed rebar are present at the piers due to impact from debris.		
Reccomendation to repair the concrete spalls with exposed rebar at the piers have been made but not addressed.		

Replace / Rehab / Repair Information

BRIDGE DECK

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Deck)	Full Deck Replacement	$78.13	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	$5.00	10	+ 1
Repair (Deck)	Patch Spalls / Seal Cracks	$3.00	See Deterioration Slope	+ 0
Replace (Bridge)	Full Bridge Replacement	$156.25	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 0
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 0

SUPERSTRUCTURE - STEEL

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	$78.13	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	$39.06	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	$5.00	See Deterioration Slope	+ 1

SUPERSTRUCTURE - CONCRETE

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	$78.13	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	$39.06	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$156.25	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

SUBSTRUCTURE - STRUCTURAL

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	$78.13	75	Rating = 8
Rehab (Substr)	Replace Structural Component	$39.06	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1

SUBSTRUCTURE - SCOUR

ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	$39.06	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	$5.00	See Deterioration Slope	+ 1
Replace (Bridge)	Full Bridge Replacement	$156.25	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	$3.00	20	+ 1
Repair (After Rehab)	Patch Spalls / Seal Cracks	$3.00	10	+ 1

Notes:

1. Individual replacements assume 50% of total bridge replacement costs

2. Individual rehabs (in cells that are not highlighted) assume 25% of total bridge replacement costs

3. When superstructure replacement is selected, either deck replacement or deck rehab should be selected as well.

APPENDIX C: CRASH MODIFICATION FACTORS AND FACTORED CONSTRUCTION UNIT COSTS

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
REHABILITATION							
Rehabilitate Pavement (AC)	$276,500	Mile	2.20	$610,000	Mill and replace 1"-3" AC pvmt; accounts for 38' width; for one direction of travel on two lane roadway; includes pavement, striping, delineators, RPMs, rumble strips	0.70	Combination of rehabilitate pavement (0.92), striping, delineators, RPMs (0.77 for combination), and rumble strips (0.89) = 0.70
Rehabilitate Bridge	$65	SF	2.20	$140	Based on deck area; bridge only - no other costs included	0.95	Assumed - should have a minor effect on crashes at the bridge
GEOMETRIC IMPROVEMENT							
Re-profile Roadway	$974,500	Mile	2.20	$2,140,000	Includes excavation of approximately 3", pavement replacement (AC), striping, delineators, RPMs, rumble strips, for one direction of travel of 2-lane roadway (38' width)	0.70	Assumed - this is similar to rehab pavement. This solution is intended to address vertical clearance at bridge, not profile issue.
Realign Roadway	$2,960,000	Mile	2.20	$6,510,000	All costs per direction except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.50	Based on CalTrans and NC DOT
Improve Skid Resistance	$675,000	Mile	2.20	$1,490,000	Average cost of pvmt replacement and variable depth paving to increase super-elevation; for one direction of travel on two lane roadway; includes pavement, striping, delineators, RPMs, rumble strips	0.66	Combination of avg of 5 values from clearinghouse (0.77) and calculated value from HSM (0.87) for skid resistance; striping, delineators, RPMs (0.77 for combination), and rumble strips (0.89) = 0.66
INFRASTRUCTURE IMPROVEMENT							
Reconstruct to Urban Section	$1,000,000	Mile	2.20	$2,200,000	Includes widening by 16' total (AC = 12'+2'+2') to provide median, curb & gutter along both side of roadway, single curb for median, striping (doesn't include widening for additional travel lane).	0.88	From HSM
Construct Auxiliary Lanes (AC)	$914,000	Mile	2.20	$2,011,000	For addition of aux lane (AC) in one direction of travel; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.78	Average of 4 values from clearinghouse
Construct Climbing Lane (High)	$3,000,000	Mile	2.20	$6,600,000	In one direction; all costs except bridges; applicable to areas with large fills and cuts, retaining walls, rock blasting, steep slopes on both sides of road	0.75	From HSM
Construct Climbing Lane (Medium)	$2,250,000	Mile	2.20	$4,950,000	In one direction; all costs except bridges; applicable to areas with medium or large fills and cuts, retaining walls, rock blasting, steep slopes on one side of road	0.75	From HSM
Construct Climbing Lane (Low)	$1,500,000	Mile	2.20	$3,300,000	In one direction; all costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.75	From HSM
Construct Passing Lane	$1,500,000	Mile	2.20	$3,300,000	In one direction; all costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.63	Average of 3 values from clearinghouse
Construct Reversible Lane (Low)	$2,400,000	Lane-Mile	2.20	$5,280,000	All costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.73 for uphill and 0.88 for downhill	Based on proposed conditions on I-17 with 2 reversible lanes and a conc barrier
Construct Reversible Lane (High)	$4,800,000	Lane-Mile	2.20	$10,560,000	All costs except bridges; applicable to areas with large fills and cuts, retaining walls, rock blasting, mountainous terrain	0.73 for uphill and 0.88 for downhill	Based on proposed conditions on I-17 with 2 reversible lanes and a conc barrier
Construct Entry/Exit Ramp	$730,000	Each	2.20	$1,610,000	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, typical earthwork & drainage; does not include any major structures or improvements on crossroad	1.09	Average of 16 values on clearinghouse; for adding a ramp not reconstructing

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
Construct Turn Lanes	$170,000	Each	2.20	$374,000	Includes 14' roadway widening (AC) for one additional turn lane (250' long) on one leg of an intersection; includes AC pavement, curb & gutter, sidewalk, ramps, striping, and minor signal modifications	0.81	Avg of 7 values from HSM
Modify Entry/Exit Ramp	$445,000	Each	2.20	$979,000	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, minor earthwork, & drainage; For converting existing ramp to parallel-type configuration	0.21	Average of 4 values from clearinghouse (for exit ramps) and equation from HSM (for entrance ramp)
Widen & Modify Entry/Exit Ramp	$619,000	Each	2.20	$1,361,800	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, minor earthwork, & drainage; For converting 1-lane ramp to 2-lane ramp and converting to parallel-type ramp	0.21	Will be same as "Modify Ramp"
Replace Pavement (AC)(with overexcavation)	$1,446,500	Mile	2.20	$3,180,000	Accounts for 38' width; for one direction of travel on two lane roadway; includes pavement, overexcavation, striping, delineators, RPMs, rumble strips	0.70	Same as rehab
Replace Pavement (PCCP)(with overexcavation)	$1,736,500	Mile	2.20	$3,820,000	Accounts for 38' width; for one direction of travel on two lane roadway; includes pavement, overexcavation, striping, delineators, RPMs, rumble strips	0.70	Same as rehab
Replace Bridge	$125	SF	2.20	$280	Based on deck area; bridge only - no other costs included	0.95	Assumed - should have a minor effect on crashes at the bridge
Widen Bridge	$175	SF	2.20	$390	Based on deck area; bridge only - no other costs included	0.90	Assumed - should have a minor effect on crashes at the bridge
Install Pedestrian Bridge	$135	SF	2.20	$300	Includes cost to construct bridge based on linear feet of the bridge. This costs includes and assumes ramps and sidewalks leading to the structure.	0.1 (ped only)	Assumed direct access on both sides of structure
Implement Automated Bridge De-icing	$115	SF	2.20	$250	Includes cost to replace bridge deck and install system	0.72 (snow/ice)	Average of 3 values on clearinghouse for snow/ice
Install Wildlife Crossing Under Roadway	$650,000	Each	2.20	$1,430,000	Includes cost of structure for wildlife crossing under roadway	0.25 (wildlife)	Assumed
Install Wildlife Crossing Over Roadway	$1,140,000	Each	2.20	$2,508,000	Includes cost of structure for wildlife crossing over roadway	0.25 (wildlife)	Assumed
Construct Drainage Structure - Minor	$280,000	Each	2.20	$616,000	Includes 3-36" pipes and roadway reconstruction (approx. 1,000 ft) to install pipes	0.70	Same as rehab
Construct Drainage Structure - Intermediate	$540,000	Each	2.20	$1,188,000	Includes 5 barrel 8'x6' RCBC and roadway reconstruction (approx. 1,000 ft) to install RCBC	0.70	Same as rehab
Construct Drainage Structure - Major	$8,000	LF	2.20	$17,600	Includes bridge that is 40' wide and reconstruction of approx. 500' on each approach	0.70	Same as rehab
Install Center Turn Lane	$450,000	Mile	2.20	$990,000	Assumes widening (AC) of undivided facility to provide directional left-turn lane or two-way left-turn lane with associated transitions, signage and markings and standard shoulders; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.86	Average of 2 values from CMF Clearinghouse
OPERATIONAL IMPROVEMENT							
Implement Variable Speed Limits (Wireless, Overhead)	$718,900	Mile	2.20	$1,580,000	In one direction; includes 2 signs per mile (foundations and structures), wireless communication, detectors	0.92	From 1 value from clearinghouse
Implement Variable Speed Limits (Wireless, Ground-mount)	$169,700	Mile	2.20	$373,300	In one direction; includes 2 signs per mile (foundations and posts), wireless communication, detectors	0.92	From 1 value from clearinghouse
Implement Variable Speed Limits (Wireless, Solar, Overhead)	$502,300	Mile	2.20	$1,110,000	In one direction; includes 2 signs per mile (foundations and structures), wireless communication, detectors, solar power	0.92	From 1 value from clearinghouse

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
Implement Variable Speed Limits (Wireless, Solar, Ground-mount)	$88,400	Mile	2.20	$194,500	In one direction; includes 2 signs per mile (foundations and posts), wireless communication, detectors, solar power	0.92	From 1 value from clearinghouse
Implement Ramp Metering (Low)	$25,000	Each	2.20	$55,000	For each entry ramp location; urban area with existing ITS backbone infrastructure; includes signals, poles, timer, pull boxes, etc	0.64	From 1 value from clearinghouse
Implement Ramp Metering (High)	$150,000	Mile	2.20	$330,000	Area without existing ITS backbone infrastructure; in addition to ramp meters, also includes conduit, fiber optic lines, and power	0.64	From 1 value from clearinghouse
Implement Signal Coordination	$140,000	Mile	2.20	$308,000	Includes conduit, conductors, and controllers for 4 intersections that span a total of approximately 2 miles	0.90	Assumed
Implement Left-turn Phasing	$7,500	Each	2.20	$16,500	Includes four new signal heads (two in each direction) and associated conductors for one intersection	0.88 (protected) 0.98 (perm/prot or prot/perm)	From HSM; CMF = 0.94 for each protected approach and 0.99 for each perm/prot or prot/perm approach. CMFs of different approaches should be multiplied together
ROADSIDE DESIGN							
Install Guardrail	$130,000	Mile	2.20	$286,000	One side of road	0.62 (ROR)	0.62 is avg of 2 values from clearinghouse
Install Cable Barrier	$80,000	Mile	2.20	$176,000	In median	0.81	0.81 is average of 5 values from clearinghouse
Widen Shoulder (AC)	$256,000	Mile	2.20	$563,000	Assumes 10' of existing shoulder (combined left and right), includes widening shoulder by a total of 4'; new pavement for 4' width and mill and replace existing 10' width; includes pavement, minor earthwork, striping edge lines, RPMs, high-visibility delineators, and rumble strips	0.68 (1-4') 0.64 (>= 4')	0.86 is avg of 5 values from clearing house for widening shoulder 1-4'. 0.76 is calculated from HSM for widening shoulder >= 4'. (Cost needs to be updated if dimension of existing and widened shoulder differ from Description.)
Rehabilitate Shoulder (AC)	$113,000	Mile	2.20	$249,000	One direction of travel (14' total shldr width-4' left and 10' right); includes paving (mill and replace), striping, high-visibility delineators, RPMs, and rumble strips for both shoulders	0.72	0.98 is average of 34 values on clearinghouse for shldr rehab/replace; include striping, delineators, RPMs (0.77 combined CMF), and rumble strips (0.89). (Cost needs to be updated if dimension of existing shoulder differs from Description.)
Replace Shoulder (AC)	$364,000	Mile	2.20	$801,000	One direction of travel (14' total shldr width-4' left and 10' right); includes paving (full reconstruction), striping, high-visibility delineators, RPMs, and rumble strips for both shoulders	0.72	0.98 is average of 34 values on clearinghouse for shldr rehab/replace; include striping, delineators, RPMs (0.77 combined CMF), and rumble strips (0.89). (Cost needs to be updated if dimension of existing shoulder differs from Description.)
Install Rumble Strip	$5,500	Mile	2.20	$12,000	Both edges - one direction of travel; includes only rumble strip; no shoulder rehab or paving or striping	0.89	Average of 75 values on clearinghouse and consistent with HSM
Install Safety Edge	$80,000	Mile	2.20	$176,000		0.87	Average of 12 values on clearinghouse
Install Wildlife Fencing	$340,000	Mile	2.20	$748,000	Fencing only plus jump outs for 1 mile (both directions)	0.50 (wildlife)	Assumed
Remove Tree/Vegetation	$200,000	Mile	2.20	$440,000	Removing trees that shade the roadway to allow sunlight to help melt snow and ice	0.72 (snow/ice)	Average of 3 values on clearinghouse for snow/ice
Install Centerline Rumble Strip	$2,800	Mile	2.20	$6,000	Includes rumble strip only; no pavement rehab or striping	0.85	From HSM
Install Access Barrier Fence	$15	LF	2.20	$33	8' fencing along residential section of roadway	0.1 (ped only)	Equal to ped overpass

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
Install Rock-Fall Mitigation - Wire Mesh	$1,320,000	Mile	2.20	$2,904,000	Includes wire mesh and rock stabilization (one direction)	0.75 (debris)	Assumed
Install Rock-Fall Mitigation - Containment Fence & Barrier	$2,112,000	Mile	2.20	$4,646,000	Includes containment fencing, concrete barrier, and rock stabilization (one direction)	0.75 (debris)	Assumed
Install Raised Concrete Barrier in Median	$650,000	Mile	2.20	$1,430,000	Includes concrete barrier with associated striping and reflective markings; excludes lighting in barrier (one direction)	0.90 (Cross-median and head on crashes eliminated completely)	All cross median and head-on fatal or incapacitating injury crashes are eliminated completely; all remaining crashes have 0.90 applied
Formalize Pullout (Small)	$7,400	Each	2.20	$16,000	Includes paving and advanced signage	0.80	Assumed
Formalize Pullout (Medium)	$27,400	Each	2.20	$60,000	Includes paving and advanced signage	0.80	Assumed
Formalize Pullout (Large)	$77,900	Each	2.20	$171,400	Includes paving and advanced signage	0.80	Assumed
INTERSECTION IMPROVEMENTS							
Construct Traffic Signal	$150,000	Each	2.20	$330,000	4-legged intersection; includes poles, foundations, conduit, controller, heads, luminaires, mast arms, etc.	0.95	From HSM
Improve Signal Visibility	$35,000	Each	2.20	$77,000	4-legged intersection; signal head size upgrade, installation of new back-plates, and installation of additional signal heads on new poles.	0.85	Avg of 7 values from clearinghouse.
Install Raised Median	$360,000	Mile	2.20	$792,000	Includes removal of 14' wide pavement and construction of curb & gutter; does not include cost to widen roadway to accommodate the median; if the roadway needs to be widened, include cost from New General Purpose Lane	0.83	Avg from HSM
Install Transverse Rumble Strip/Pavement Markings	$3,000		2.20	$7,000	Includes ped markings and rumble strips only across a 30' wide travelway; no pavement rehab or other striping	0.95	Avg of 17 values from clearinghouse.
Construct Single-Lane Roundabout	$1,500,000	Each	2.20	$3,300,000	Removal of signal at 4-legged intersection; realignment of each leg for approx. 800 feet including paving, curbs, sidewalk, striping, lighting, signing	0.22	From HSM
Construct Double-Lane Roundabout	$1,800,000	Each	2.20	$3,960,000	Removal of signal at 4-legged intersection; realignment of each leg for approx. 800 feet including paving, curbs, sidewalk, striping, lighting, signing	0.40	From HSM
Install High-Visibility Edge Line Striping	$10,800	Mile	2.20	$23,800	2 edge lines and lane line - one direction of travel	0.77	Avg of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs. (If implemented separately, CMF will be higher.)
Install High-Visibility Delineators	$6,500	Mile	2.20	$14,300	Both edges - one direction of travel		Avg of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs. (If implemented separately, CMF will be higher.)
Install Raised Pavement Markers	$2,000	Mile	2.20	$4,400	Both edges - one direction of travel		Avg of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs. (If implemented separately, CMF will be higher.)
Install In-Lane Route Markings	$6,000	Each	2.20	$13,200	Installation of a series of three in-lane route markings in one lane	0.95	Assumed

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
IMPROVED VISIBILITY							
Cut Side Slopes	$80	LF	2.20	$200	For small grading to correct sight distance issues; not major grading	0.85	Intent of this solution is to improve sight distance. Most CMF's are associated with vehicles traveling on slope. Recommended CMF is based on FDOT and NCDOT but is more conservative.
Install Lighting (connect to existing power)	$270,000	Mile	2.20	$594,000	One side of road only; offset lighting, not high-mast; does not include power supply; includes poles, luminaire, pull boxes, conduit, conductor	0.75 (night)	Average of 3 values on clearinghouse & consistent with HSM
Install Lighting (solar powered LED)	$10,000	Pole	2.20	$22,000	Offset lighting, not high-mast; solar power LED; includes poles, luminaire, solar panel	0.75 (night)	Average of 3 values on clearinghouse & consistent with HSM
DRIVER INFORMATION/WARNING							
Install Dynamic Message Sign (DMS)	$250,000	Each	2.20	$550,000	Includes sign, overhead structure, and foundations; wireless communication; does not include power supply	1.00	Not expected to reduce crashes
Install Dynamic Weather Warning Beacons	$40,000	Each	2.20	$88,000	Assumes solar operation and wireless communication or connection to existing power and communication; ground mounted; includes posts, foundations, solar panel, and dynamic sign	0.80 (weather related)	Avg of 3 values from from FHWA Desktop Reference for installing pavement condition warning signs
Install Dynamic Speed Feedback Signs	$25,000	Each	2.20	$55,000	Assumes solar operation and no communication; ground mounted; includes regulatory sign, posts, foundations, solar panel, and dynamic sign	0.94	Average of 2 clearinghouse values
Install Chevrons	$18,400	Mile	2.20	$40,500	On one side of road - includes signs, posts, and foundations	0.79	Average of 11 values on clearinghouse
Install Curve Warning Signs	$2,500	Each	2.20	$5,500	Includes 2 signs, posts, and foundations	0.83	Average of 4 clearinghouse values
Install Traffic Control Device Warning Signs (e.g., stop sign ahead, signal ahead, etc.)	$2,500	Each	2.20	$5,500	Includes 2 signs, posts, and foundations	0.85	FHWA Desktop Reference
Install Other General Warning Signs (e.g., intersection ahead, wildlife in area, slow vehicles, etc.)	$2,500	Each	2.20	$5,500	Includes 2 signs, posts, and foundations	0.97	Assumed
Install Wildlife Warning System	$162,000	Each	2.20	$356,400	Includes wildlife detection system, flashing warning signs (assumes solar power), advance signing, CCTV (solar and wireless), and fencing for approximately 2 miles in each direction	0.50 (wildlife)	Assumed
Install Warning Sign with Beacons	$15,000	Each	2.20	$33,000	In both directions; includes warning sign, post, and foundation, and flashing beacons (assumes solar power) at one location	0.75	FHWA Desktop Reference for Installing Flashing Beacons as Advance Warning
Install Larger Stop Sign with Beacons	$10,000	Each	2.20	$22,000	In one direction; includes large stop sign, post, and foundation, and flashing beacons (assumes solar power) at one location	0.85/0.81	Use 0.85 for adding beacons to an existing sign; 0.81 for installing a larger sign with flashing beacons
DATA COLLECTION							
Install Roadside Weather Information System (RWIS)	$60,000	Each	2.20	$132,000	Assumes wireless communication and solar power, or connection to existing power and communications	1.00	Not expected to reduce crashes
Install Closed Circuit Television (CCTV) Camera	$25,000	Each	2.20	$55,000	Assumes connection to existing ITS backbone or wireless communication; does not include fiber-optic backbone infrastructure; includes pole, camera, etc	1.00	Not expected to reduce crashes

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
Install Vehicle Detection Stations	$15,000	Each	2.20	$33,000	Assumes wireless communication and solar power, or connection to existing power and communications	1.00	Not expected to reduce crashes
Install Flood Sensors (Activation)	$15,000	Each	2.20	$33,000	Sensors with activation cabinet to alert through texting (agency)	1.00	Not expected to reduce crashes
Install Flood Sensors (Gates)	$100,000	Each	2.20	$220,000	Sensors with activation cabinet to alert through texting (agency) and beacons (public) plus gates	1.00	Not expected to reduce crashes
WIDEN CORRIDOR							
Construct New General Purpose Lane (PCCP)	$1,740,000	Mile	2.20	$3,830,000	For addition of 1 GP lane (PCCP) in one direction; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.90	North Carolina DOT uses 0.90 and Florida DOT uses 0.87
Construct New General Purpose Lane (AC)	$1,200,000	Mile	2.20	$2,640,000	For addition of 1 GP lane (AC) in one direction; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.90	North Carolina DOT uses 0.90 and Florida DOT uses 0.88
Convert a 2-lane undivided highway to a 5-lane highway	$1,576,000	Mile	2.20	$3,467,200	For expanding a 2-lane undivided highway to a 5-lane highway (4 through lanes with TWLTL), includes standard shoulder widths but no curb, gutter, or sidewalks	0.70	Assumed to be slightly lower than converting from a 4-lane to a 5-lane highway
Convert a 4-lane undivided highway to a 5-lane highway	$1,053,000	Mile	2.20	$2,316,600	For expanding a 4-lane undivided highway to a 5-lane highway (4 through lanes with TWLTL), includes standard shoulder widths but no curb, gutter, or sidewalk	0.75	From FHWA Desktop Reference for CRFs, CMF Clearinghouse, and SR 87 CPS comparison
Construct 4-lane Divided Highway (Using Existing 2-lane Road for one direction)	$3,000,000	Mile	2.20	$6,600,000	In both directions; one direction uses existing 2-lane road; other direction assumes addition of 2 new lanes (AC) with standard shoulders; includes all costs except bridges	0.67	Assumed
Construct 4-lane Divided Highway (No Use of Existing Roads)	$6,000,000	Mile	2.20	$13,200,000	In both directions; assumes addition of 2 new lanes (AC) with standard shoulders in each direction; includes all costs except bridges	0.67	Assumed
Construct Bridge over At-Grade Railroad Crossing	$10,000,000	Each	2.20	$22,000,000	Assumes bridge width of 4 lanes (AC) with standard shoulders; includes abutments and bridge approaches; assumes vertical clearance of 23'4" + 6'8" superstructure	0.72 (All train-related crashes eliminated)	Removes all train-related crashes at at-grade crossing; all other crashes CMF = 0.72
Construct Underpass at At-Grade Railroad Crossing	$15,000,000	Each	2.20	$33,000,000	Assumes underpass width of 4 lanes (AC) with standard shoulders; includes railroad bridge with abutments and underpass approaches; assumes vertical clearance of 16'6" + 6'6" superstructure	0.72 (All train-related crashes eliminated)	Removes all train-related crashes at at-grade crossing; all other crashes CMF = 0.72
Construct High-Occupancy Vehicle (HOV) Lane	$900,000	Mile	2.20	$1,980,000	For addition of 1 HOV lane (AC) in one direction with associated signage and markings; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.95	Similar to general purpose lane
ALTERNATE ROUTE							
Construct Frontage Roads	$2,400,000	Mile	2.20	$5,280,000	For 2-lane AC frontage road; includes all costs except bridges; for generally at-grade facility with minimal walls	0.90	Assumed - similar to new general purpose lane
Construct 2-lane Undivided Highway	$3,000,000	Mile	2.20	$6,600,000	In both directions; assumes addition of 2 new lanes (AC) with standard shoulders in each direction; includes all costs except bridges	0.90	Assuming new alignment for a bypass

APPENDIX D: PERFORMANCE AREA RISK FACTORS

Pavement Performance Area

- Mainline Daily Traffic Volume
- Mainline Daily Truck Volume
- Elevation
- Interrupted Flow

Elevation

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score	Condition
0	< 4000’
0-5	4000’- 9000’
5	> 9000’

Mainline Daily Traffic Volume

Exponential equation; score = $5-(5*e^{(ADT*-0.000039)})$

Score	Condition
0	< 6,000
0-5	6,000 – 160,000
5	>160,000

Mainline Daily Truck Volume

Exponential equation; score = $5-(5*e^{(ADT*-0.00025)})$

Score	Condition
0	<900
0-5	900-25,000
5	>25,000

Interrupted Flow

Score	Condition
0	Not interrupted flow
5	Interrupted Flow

Bridge Performance Area

- Mainline Daily Traffic Volume
- Detour Length
- Elevation
- Scour Critical Rating
- Carries Mainline Traffic
- Vertical Clearance

Mainline Daily Traffic Volume

Exponential equation; score = $5-(5*e^{(ADT*-0.000039)})$

Score	Condition
0	<6,000
0-5	6,000-160,000
5	>160,000

Elevation

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score	Condition
0	< 4000’
0-5	4000’- 9000’
5	> 9000’

Carries Mainline

Score	Condition
0	Does not carry mainline traffic
5	Carries mainline traffic

Detour Scale

Divides detour length by 10 and multiplies by 2.5

Score	Condition
0	0 miles
0-5	0-20 miles
5	> 20 miles

Scour

Variance below 8

Score	Condition
0	Rating > 8
0-5	Rating 8 - 3
5	Rating < 3

Vertical Clearance

Variance below 16’ x 2.5; (16 –Clearance) x 2.5

Score	Condition
0	>16’
0-5	16’-14’
5	<14’

Mobility Performance Area

- Mainline VMT
- Detour Length
- Buffer Index (PTI-TTI)
- Shoulder Width

Mainline VMT

Exponential equation; score = 5-(5*e$^{(ADT*-0.0000139)}$)

Score	Condition
0	<16,000
0-5	16,000-400,000
5	>400,000

Buffer Index

Buffer Index x 10

Score	Condition
0	Buffer Index = 0.00
0-5	Buffer Index 0.00-0.50
5	Buffer Index > 0.50

Detour Length

Score	Condition
0	Detour < 10 miles
5	Detour > 10 miles

Shoulder Width

Variance below 10', if only 1 lane in each direction

Score	Condition
0	10' or above or >1 lane in each direction
0-5	10'-5' and 1 lane in each direction
5	5' or less and 1 lane in each direction

Safety Performance Area

- Mainline Daily Traffic Volume
- Vertical Grade
- Shoulder width (Right)
- Elevation
- Interrupted Flow

Mainline Daily Traffic Volume

Exponential equation; score = 5-(5*e$^{(ADT*-0.000039)}$)

Score	Condition
0	<6,000
0-5	6,000-160,000
5	>160,000

Interrupted Flow

Score	Condition
0	Not interrupted flow
5	Interrupted Flow

Elevation

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score	Condition
0	< 4000'
0-5	4000'- 9000'
5	> 9000'

Shoulder Right side)

Variance below 10'

Score	Condition
0	10' or above
0-5	10' - 5'
5	5' or less

Grade

Variance above 3% x 1.5

Score	Condition
0	< 3%
0-5	3% - 6.33%
5	>6.33%

Freight Performance Area

- Mainline Daily Truck Volume
- Detour Length
- Truck Buffer Index (TPTI-TTTI)
- Shoulder Width

Mainline Daily Truck Volume

Exponential equation; score = 5-(5*e$^{(ADT*-0.00025)}$)

Score	Condition
0	<900
0-5	900-25,000
5	>25,000

Detour Length

Score	Condition
0	Detour < 10 miles
5	Detour > 10 miles

Truck Buffer Index

Truck Buffer Index x 10

Score	Condition
0	Buffer Index = 0.00
0-5	Buffer Index 0.00-0.50
5	Buffer Index > 0.50

Shoulder Width

Variance below 10', if only 1 lane in each direction

Score	Condition
0	10' or above or >1 lane in each direction
0-5	10'-5' and 1 lane in each direction
5	5' or less and 1 lane in each direction

Solution Number	Mainline Traffic Vol (vpd) (2-way)	Solution Length (miles)	Bridge Detour Length (miles) (N19)	Elevation (ft)	Scour Critical Rating (0-9)	Carries Mainline Traffic (Y/N)	Bridge Vert. Clear (ft)	Mainline Truck Vol (vpd) (2-way)	Detour Length > 10 miles (Y/N)	Truck Buffer Index	Non-Truck Buffer Index	Grade (%)	Interrupted Flow (Y/N)	Outside/ Right Shoulder Width (ft)	1-lane each direction
191.1A	1,384	4.3	25	1,000	8	y	16.00	235	y	18.13	8.67	1	y	2.35	y
191.1B	1,384	4.3	25	1,000	8	y	16.00	235	y	18.13	8.67	1	y	2.35	y
191.2	8,312	0		3,000				1,413	n	18.13	8.67	1	y	2.63	y
70.4-1	3,295	19		2,000				165	y	0.20	0.20	3	n	5.07	y
70.4-2	3,295	4		2,000				165	y	0.20	0.20	3	n	4.62	y
70.4-3	4,230	2		2,000				465	y	0.20	0.20	3	n	5.38	y
70.4-4	4,230	2		2,000				465	y	0.20	0.20	3	n	5.38	y
70.4-5	4,230	3		2,000				465	y	0.20	0.20	3	n	5.38	y
70.4-6	4,230	3		2,000				465	y	0.20	0.20	3	n	5.38	y
70.4-7	3,295	7		2,000				165	y	0.20	0.20	3	n	5.07	y
70.5	4,230	2		2,000				465	y	0.20	0.20	3	n	5.38	y
60.6	11,008	0.02	65	3,500	7	y	16.00	1,321	y	4.70	2.00	3	y	2.35	n
60.7	11,008	0.03	65	3,500	7	y	16.00	1,321	y	4.70	2.00	3	y	2.35	n
60.8	11,008	5.5		3,500				1,321	y	4.70	2.00	3	y	4.59	n
60.9	11,008			3,500				1,321	y	4.70	2.00		y	4.59	n
60.10	9,069	0.11	65	3,000	8	y	16.00	1,270	y	1.16	0.87	3	n	2.35	y
60.11	9,069	0.03	65	3,700	8	y	16.00	1,270	y	1.16	0.87	3	n	2.35	n
60.12A	9,069	16		3,500				1,270	y	1.16	0.87	5	n	4.82	y
60.12B	9,069	16	65	3,500	8	y	16.00	907	y	1.16	0.87	5	n	4.82	y
60.12C	9,069	16	65	3,500	8	y	16.00	907	y	1.16	0.87	5	n	4.82	y
60.13	9,069	2		4,200				907	y	1.16	0.87	5	n	4.82	y
60.14	9,069	2		3,500				907	y	1.16	0.87	5	n	4.82	y

Solution Number	Bridge	Pavement	Mobility	Safety	Freight	Risk Score (0 to 10)				
						Bridge	Pavement	Mobility	Safety	Freight
191.1A	y	y	y	y	y	3.42	0.37	7.70	4.10	7.64
191.1B	y	y	y	y	y	3.42	0.37	7.70	4.10	7.64
191.2	n	n	y	y	y	0.00	0.00	5.00	4.55	5.75
70.4-1	n	n	y	y	y	0.00	0.00	7.42	2.21	6.07
70.4-2	n	n	y	y	y	0.00	0.00	6.42	2.24	6.10
70.4-3	n	n	y	y	y	0.00	0.00	6.09	2.15	6.09
70.4-4	n	n	y	y	y	0.00	0.00	6.09	2.15	6.09
70.4-5	n	n	y	y	y	0.00	0.00	6.21	2.15	6.09
70.4-6	n	n	y	y	y	0.00	0.00	6.21	2.15	6.09
70.4-7	n	n	y	y	y	0.00	0.00	6.65	2.21	6.07
70.5	n	y	y	y	y	0.00	0.87	6.09	2.15	6.09
60.6	y	n	y	y	y	4.24	0.00	3.28	4.69	5.02
60.7	y	n	y	y	y	4.24	0.00	3.28	4.69	5.02
60.8	n	y	y	y	y	0.00	2.10	4.69	4.69	5.02
60.9	n	y	n	n	y	3.83	0.00	7.53	2.59	8.18
60.10	y	n	y	y	y	3.83	0.00	7.53	2.59	8.18
60.11	y	n	y	y	y	3.83	0.00	5.01	2.59	5.68
60.12A	n	n	y	y	y	0.00	0.00	9.67	3.79	8.18
60.12B	y	y	y	y	y	3.83	1.66	9.67	3.79	8.01
60.12C	y	y	y	y	y	3.83	1.66	9.67	3.79	8.01
60.13	n	n	y	y	y	0.00	0.00	8.06	3.87	8.01
60.14	n	n	y	y	y	0.00	0.00	8.06	3.79	8.01

APPENDIX E: PERFORMANCE EFFECTIVENESS SCORES

				Solution #	191.1A	191.1B	191.2	70.4-1	70.4-2	70.4-3	70.4-4	70.4-5	70.4-6	70.4-7	70.5
				Description	US 191 Elfrida to I-10 Freight Mitigation: Widen shoulders, realign roadway, replace Cochise RR bridge	US 191 Elfrida to I-10 Freight Mitigation: Construct passing lanes, realign roadway, replace Cochise RR bridge	US191 Safford Safety Improvements	US 70 San Carlos Safety Improvements	US 70 San Carlos Safety Improvements	US 70 San Carlos Safety Improvements	US 70: EB climbing lane	US 70: EB passing lane	US 70: WB passing lane	US 70: WB passing lane	US 70 Cutter Safety Improvements
	LEGEND:			Project Beg MP	59.9	59.9	118	274	270	268	262	267	267	281	257
		- user entered value		Project End MP	64.2	64.2	118	293	274	270	264	270	270	288	259
		- calculated value for reference only		Project Length (miles)	4.3	4.3	0	19	4	2	2	3	3	7	2
		- calculated value for entry/use in other spreadsheet		Segment Beg MP	24	24	116	274	270	255	255	255	255	274	255
		- for input into Performance Effectiveness Score spreadsheet		Segment End MP	67	67	121	293	274	270	270	270	270	293	270
		- assumed values (do not modify)		Segment Length (miles)	43	43	5	19	4	15	15	15	15	19	15
				Segment #	191-2	191-2	191-5	70-10	70-11	70-12	70-12	70-12	70-12	70-10	70-12
				Current # of Lanes (both directions)	2	2	4	2	2	2	2	2	2	2	2
				Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	one-way	one-way	one-way	one-way	two-way
				Additional Lanes (one-way)		1					1	1	1	1	
				Pro-Rated # of Lanes	2.00	2.20	4.00	2.00	2.00	2.00	2.13	2.20	2.20	2.37	2.00
		Notes and Directions	**Description**												
SAFETY	**DIRECTIONAL SAFETY**	Input current value from performance system (direction 1)	Orig Segment Directional Safety Index (NB/WB)		0.530	0.530	1.340	1.500	3.570	1.670	1.670	1.670	1.670	1.500	1.670
		Input current value from performance system (direction 1)	Orig Segment Directional Fatal Crashes (NB/WB)		1	1	1	2	1	2	2	2	2	2	2
		Input current value from performance system (direction 1)	Orig Segment Directional Incap Crashes (NB/WB)		1	1	2	0	0	0	0	0	0	0	0
		Input current value from performance system (direction 1)	Original Fatal Crashes in project limits (NB/WB)		0	0					0	0	0	1	
		Input current value from performance system (direction 1)	Original Incap Crashes in project limits (NB/WB)		0	0					0	0	0	0	
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 1 (direction 1)(lowest CMF)		0.5	0.5					1	1	0.63	0.63	
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 2 (direction 1)		0.68	0.63	Calculated in separate worksheet	Calculated in separate worksheet	Calculated in separate worksheet	Calculated in separate worksheet	1	1	1	1	Calculated in separate worksheet
		Input CMF value (direction 1) - If no CMF enter 1.1	CMF 3 (direction 1)		0.93	0.93					1	1	1	1	
		Input CMF value (direction 1) - If no CMF enter 1.2	CMF 4 (direction 1)		1	1					1	1	1	1	
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 5 (direction 1)		1	1					1	1	1	1	
		Calculated Value (direction 1)	Total CMF (NB/WB)		0.500	0.500	See Worksheet	See Worksheet	See Worksheet	See Worksheet	1.000	1.000	0.630	0.630	See Worksheet
		Calculated Value (direction 1)	Fatal Crash reduction (direction 1)		0.000	0.000	0.706	1.920	0.730	0.000	0.000	0.000	0.000	0.370	1.032
		Calculated Value (direction 1)	Incap Crash reduction (direction 1)		0.000	0.000	1.440	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 1)	Post-Project Segment Directional Fatal Crashes (direction 1)		1.000	1.000	0.294	0.080	0.270	2.000	2.000	2.000	2.000	1.630	0.968
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 1)	Post-Project Segment Directional Incap Crashes (direction 1)		1.000	1.000	0.560	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Input value from updated Safety Index spreadsheet (direction 1)	Post-Project Segment Directional Safety Index (direction 1)		0.530	0.530	0.950	0.750	1.780	1.670	1.670	1.670	1.670	1.220	0.810
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need (direction 1)	Post-Project Segment Directional Safety Index (direction 1)		0.530	0.530	0.950	0.750	1.780	1.670	1.670	1.670	1.670	1.220	0.810
		Input current value from performance system (direction 2)	Orig Segment Directional Safety Index (SB/EB)		0.030	0.030	1.250	2.250	1.670	1.670	1.670	1.670	1.670	2.250	1.670
		Input current value from performance system (direction 2)	Orig Segment Directional Fatal Crashes (direction 2)		0	0	1	3	3	2	2	2	2	3	2
		Input current value from performance system (direction 2)	Orig Segment Directional Incap Crashes (direction 2)		1	1	1	0	0	0	0	0	0	0	0
		Input current value from performance system (direction 2)	Original Fatal Crashes in project limits (direction 2)		0	0					0	1	0	3	1
		Input current value from performance system (direction 2)	Original Incap Crashes in project limits (direction 2)		0	0					0	0	0	0	0
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 1 (direction 2)(lowest CMF)		0.5	0.5					0.63	0.63	0.63	0.63	0.64
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 2 (direction 2)		0.68	0.63	Calculated in separate worksheet	Calculated in separate worksheet	Calculated in separate worksheet	Calculated in separate worksheet	1	1	1	1	0.89
		Input CMF value (direction 2) - If no CMF enter 1.1	CMF 3 (direction 2)		0.93	0.93					1	1	1	1	1
		Input CMF value (direction 2) - If no CMF enter 1.2	CMF 4 (direction 2)		1	1					1	1	1	1	1
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 5 (direction 2)		1	1					1	1	1	1	1
		Calculated Value (direction 2)	Total CMF (direction 2)		0.500	0.500	See Worksheet	See Worksheet	See Worksheet	See Worksheet	0.630	0.630	0.630	0.630	See Worksheet
		Calculated Value (direction 2)	Fatal Crash reduction (direction 2)		0.000	0.000	0.655	1.428	1.609	0.734	0.000	0.370	0.000	1.110	0.516
		Calculated Value (direction 2)	Incap Crash reduction (direction 2)		0.000	0.000	0.366	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 2)	Post-Project Segment Directional Fatal Crashes (direction 2)		0.000	0.000	0.345	1.572	1.391	1.266	2.000	1.630	2.000	1.890	1.484
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 2)	Post-Project Segment Directional Incap Crashes (direction 2)		1.000	1.000	0.634	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Input value from updated Safety Index spreadsheet (direction 2)	Post-Project Segment Directional Safety Index (direction 2)		0.030	0.030	1.250	1.130	0.000	1.250	1.670	1.360	1.670	1.420	1.240
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need (direction 2)	Post-Project Segment Directional Safety Index (direction 2)		0.030	0.030	1.250	1.130	0.000	1.250	1.670	1.360	1.670	1.420	1.240
	SAFETY INDEX	Calculated Value - verify that it matches current performance system	Current Safety Index		0.280	0.280	1.295	1.875	2.620	1.670	1.670	1.670	1.670	1.875	1.670
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need	Post-Project Safety Index		0.280	0.280	1.100	0.940	0.890	1.460	1.670	1.515	1.670	1.320	1.021
	Needs	User entered value from Safety Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Safety Need		0.174	0.174	2.857	5.959	8.368	5.160	5.160	5.160	5.160	5.959	5.160
		User entered value from Safety Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Safety Need		0.174	0.174	1.935	1.307	1.488	4.394	5.061	4.569	5.061	4.027	3.312

			Solution #	**191.1A**	**191.1B**	**191.2**	**70.4-1**	**70.4-2**	**70.4-3**	**70.4-4**	**70.4-5**	**70.4-6**	**70.4-7**	**70.5**
			Description	US 191 Elfrida to I-10 Freight Mitigation: Widen shoulders, realign roadway, replace Cochise RR bridge	US 191 Elfrida to I-10 Freight Mitigation: Construct passing lanes, realign roadway, replace Cochise RR bridge	US191 Safford Safety Improvements	US 70 San Carlos Safety Improvements	US 70 San Carlos Safety Improvements	US 70 San Carlos Safety Improvements	US 70: EB climbing lane	US 70: EB passing lane	US 70: WB passing lane	US 70: WB passing lane	US 70 Cutter Safety Improvements
	LEGEND:		Project Beg MP	59.9	59.9	118	274	270	268	262	267	267	281	257
		- user entered value	Project End MP	64.2	64.2	118	293	274	270	264	270	270	288	259
		- calculated value for reference only	Project Length (miles)	4.3	4.3	0	19	4	2	2	3	3	7	2
		- calculated value for entry/use in other spreadsheet	Segment Beg MP	24	24	116	274	270	255	255	255	255	274	255
		- for input into Performance Effectiveness Score spreadsheet	Segment End MP	67	67	121	293	274	270	270	270	270	293	270
		- assumed values (do not modify)	Segment Length (miles)	43	43	5	19	4	15	15	15	15	19	15
			Segment #	191-2	191-2	191-5	70-10	70-11	70-12	70-12	70-12	70-12	70-10	70-12
			Current # of Lanes (both directions)	2	2	4	2	2	2	2	2	2	2	2
			Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	one-way	one-way	one-way	one-way	two-way
			Additional Lanes (one-way)		1					1	1	1	1	
			Pro-Rated # of Lanes	2.00	2.20	4.00	2.00	2.00	2.00	2.13	2.20	2.20	2.37	2.00
		Notes and Directions	**Description**											
MOBILITY	**MOBILITY INDEX**	Input current value from performance system	Original Segment Mobility Index	0.090	0.090	0.330	0.170	0.210	0.190	0.190	0.190	0.190	0.170	0.190
		Enter in Mobility Index Spreadsheet to determine new segment level Mobility Index	Post-Project # of Lanes (both directions)	2.00	2.20	4.00	2.00	2.00	2.00	2.13	2.20	2.20	2.37	2.00
		Input value from updated Mobility Index spreadsheet	Post-Project Segment Mobility Index	0.09	0.05	0.33	0.17	0.21	0.19	0.14	0.14	0.14	0.10	0.19
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Mobility Index	0.090	0.050	0.330	0.170	0.210	0.190	0.140	0.140	0.140	0.100	0.190
	FUT V/C	Input current value from performance system	Original Segment Future V/C	0.100	0.100	0.390	0.190	0.260	0.230	0.230	0.230	0.230	0.190	0.230
		Input value from updated Mobility Index spreadsheet	Post-Project Segment Future V/C	0.100	0.050	0.390	0.190	0.260	0.230	0.170	0.170	0.170	0.110	0.230
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Future V/C	0.100	0.050	0.390	0.190	0.260	0.230	0.170	0.170	0.170	0.110	0.230
	PEAK HOUR V/C	Input current value from performance system (direction 1)	Original Segment Peak Hour V/C (NB/WB)	0.070	0.070	0.270	0.110	0.120	0.130	0.130	0.130	0.130	0.110	0.130
		Input current value from performance system (direction 2)	Original Segment Peak Hour V/C (SB/EB)	0.070	0.070	0.280	0.110	0.120	0.130	0.130	0.130	0.130	0.110	0.130
		***If One-Way project**, enter in Mobility Index Spreadsheet to determine new segment level Peak Hour V/C. **If Two-Way project,** disregard	Adjusted total # of Lanes for use in directional peak hr	N/A	N/A	N/A	N/A	N/A	N/A	2.27	2.40	2.40	2.74	N/A
		Input value from updated Mobility Index spreadsheet (direction 1)	Post-Project Segement Peak Hr V/C (NB/WB)	0.070	0.040	0.27	0.11	0.12	0.13	0.10	0.10	0.10	0.06	0.13
		Input value from updated Mobility Index spreadsheet (direction 2)	Post-Project Segement Peak Hr V/C (SB/EB)	0.070	0.040	0.28	0.11	0.12	0.13	0.10	0.10	0.10	0.06	0.13
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Peak Hr V/C (direction 1)	0.070	0.040	0.270	0.110	0.120	0.130	0.100	0.100	0.100	0.060	0.130
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Peak Hr V/C (direction 2)	0.070	0.040	0.280	0.110	0.120	0.130	0.100	0.100	0.100	0.060	0.130
	TTI AND PTI	Calculated Value (both directions)	Safety Reduction Factor	0.750	0.750	0.849	0.501	0.340	0.874	1.000	0.907	1.000	0.704	0.611
		Calculated Value (both directions)	Safety Reduction	0.250	0.250	0.151	0.499	0.660	0.126	0.000	0.093	0.000	0.296	0.389
		Calculated Value (both directions)	Mobility Reduction Factor	0.750	0.750	1.000	1.000	1.000	1.000	0.737	0.737	0.737	0.588	1.000
		Calculated Value (both directions)	Mobility Reduction	0.250	0.250	0.000	0.000	0.000	0.000	0.263	0.263	0.263	0.412	0.000
		Input current value from performance system (direction 1)	Original Directional Segment TTI (NB/WB)	1.160	1.160	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Input current value from performance system (direction 1)	Original Directional Segment PTI (NB/WB)	9.830	9.830	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Input current value from performance system (direction 2)	Original Directional Segment TTI (SB/EB)	1.160	1.160	N/A	N/A	N/A	1.100	1.100	1.100	1.100	N/A	1.100
		Input current value from performance system (direction 2)	Original Directional Segment PTI (SB/EB)	6.090	6.090	N/A	N/A	N/A	1.400	1.400	1.400	1.400	N/A	1.400
		Calculated Value (both directions)	Reduction Factor for Segment TTI	0.075	0.075	0.000	0.000	0.000	0.000	0.000	0.079	0.079	0.124	0.000
		Calculated Value (both directions)	Reduction Factor for Segment PTI	0.125	0.125	0.045	0.150	0.000	0.000	0.000	0.080	0.053	0.171	0.117
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Directional Segment TTI (direction 1)	1.073	1.073	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Directional Segment PTI (direction 1)	8.601	8.601	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Directional Segment TTTI (direction 2)	1.073	1.073	#VALUE!	#VALUE!	#VALUE!	1.100	1.100	1.100	1.100	N/A	1.100
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Directional Segment TPTI (direction 2)	5.329	5.329	#VALUE!	#VALUE!	#VALUE!	1.400	1.400	1.400	1.400	N/A	1.237
	CLOSURE EXTENT	Input current value from performance system (direction 1)	Orig Segment Directional Closure Extent (NB/WB)	0.020	0.020	0.120	0.090	0.100	0.040	0.040	0.040	0.040	0.090	0.040
		Input current value from performance system (direction 2)	Orig Segment Directional Closure Extent (SB/EB)	0.000	0.000	0.080	0.040	0.000	0.310	0.310	0.310	0.310	0.040	0.310
		Input value from HCRS	Segment Closures with fatalities/injuries	1	1	3	5	0	4	4	4	4	5	4
		Input value from HCRS	Total Segment Closures	5	5	5	6	2	7	7	7	7	6	7
		Calculated Value (both directions)	% Closures with Fatality/Injury	0.20	0.20	0.60	0.83	0.00	0.57	0.57	0.57	0.57	0.83	0.57
		Calculated Value (both directions)	Closure Reduction	0.050	0.050	0.090	0.416	0.000	0.072	0.000	0.053	0.000	0.247	0.222
		Calculated Value (both directions)	Closure Reduction Factor	0.950	0.950	0.910	0.584	1.000	0.928	1.000	0.947	1.000	0.753	0.778
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Segment Directional Closure Extent (direction 1)	0.019	0.019	0.109	0.053	0.100	0.037	0.040	0.038	0.040	0.068	0.031
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Segment Directional Closure Extent (direction 2)	0.000	0.000	0.073	0.023	0.000	0.288	0.310	0.310	0.310	0.040	0.241
	BICYCLE ACCOM	Input current value from performance system	Orig Segment Bicycle Accomodation %	0.0%	0.0%	27.0%	4.0%	4.0%	23.0%	23.0%	23.0%	23.0%	4.0%	23.0%
		Input current value from performance system	Orig Segment Outside Shoulder width	0	0	3	5	5	5	5	5	5	5	5
		Input value from updated Mobility Index spreadsheet	Post-Project Segment Outside Shoulder width	14	0	3	14	14	14	5	5	5	5	5
		Input value from updated Mobility Index spreadsheet	Post-Project Segment Bicycle Accomodation (%)	100.0%	0.0%	27.0%	100.0%	100.0%	100.0%	23.0%	23.0%	23.0%	4.0%	100.0%
		Enter in Mobiity Needs spreadsheet to calculate new segment level Mobility Need	Post-Project Segment Bicycle Accomodation (%)	100.0%	0.0%	27.0%	100.0%	100.0%	100.0%	23.0%	23.0%	23.0%	4.0%	100.0%
	Needs	User entered value from Mobility Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Mobility Need	1.474	1.474	0.921	0.886	0.884	0.964	0.964	0.964	0.964	0.886	0.964
		User entered value from Mobility Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Mobility Need	0.669	1.338	0.918	0.194	0.193	0.351	0.949	0.933	0.949	0.813	0.341

				Solution #	**191.1A**	**191.1B**	**191.2**	**70.4-1**	**70.4-2**	**70.4-3**	**70.4-4**	**70.4-5**	**70.4-6**	**70.4-7**	**70.5**
				Description	US 191 Elfrida to I-10 Freight Mitigation: Widen shoulders, realign roadway, replace Cochise RR bridge	US 191 Elfrida to I-10 Freight Mitigation: Construct passing lanes, realign roadway, replace Cochise RR bridge	US191 Safford Safety Improvements	US 70 San Carlos Safety Improvements	US 70 San Carlos Safety Improvements	US 70 San Carlos Safety Improvements	US 70: EB climbing lane	US 70: EB passing lane	US 70: WB passing lane	US 70: WB passing lane	US 70 Cutter Safety Improvements
	LEGEND:			Project Beg MP	59.9	59.9	118	274	270	268	262	267	267	281	257
		- user entered value		Project End MP	64.2	64.2	118	293	274	270	264	270	270	288	259
		- calculated value for reference only		Project Length (miles)	4.3	4.3	0	19	4	2	2	3	3	7	2
		- calculated value for entry/use in other spreadsheet		Segment Beg MP	24	24	116	274	270	255	255	255	255	274	255
		- for input into Performance Effectiveness Score spreadsheet		Segment End MP	67	67	121	293	274	270	270	270	270	293	270
		- assumed values (do not modify)		Segment Length (miles)	43	43	5	19	4	15	15	15	15	19	15
				Segment #	191-2	191-2	191-5	70-10	70-11	70-12	70-12	70-12	70-12	70-10	70-12
				Current # of Lanes (both directions)	2	2	4	2	2	2	2	2	2	2	2
				Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	one-way	one-way	one-way	one-way	two-way
				Additional Lanes (one-way)		1					1	1	1	1	
				Pro-Rated # of Lanes	2.00	2.20	4.00	2.00	2.00	2.00	2.13	2.20	2.20	2.37	2.00
		Notes and Directions	**Description**												
FREIGHT	**TTTI AND TPTI**	Input current value from performance system (direction 1)	Original Directional Segment TTTI (NB/WB)		1.000	1.000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Input current value from performance system (direction 1)	Original Directional Segment TPTI (NB/WB)		2.680	2.680	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Input current value from performance system (direction 2)	Original Directional Segment TTTI (SB/EB)		1.540	1.540	N/A	N/A	N/A	1.140	1.140	1.140	1.140	N/A	1.140
		Input current value from performance system (direction 2)	Original Directional Segment TPTI (SB/EB)		19.670	19.670	N/A	N/A	N/A	2.010	2.010	2.010	2.010	N/A	2.010
		Calculated Value (both directions)	Reduction Factor for Segment TTTI (both directions)		0.038	0.038	0.000	0.000	0.000	0.000	0.000	0.039	0.039	0.062	0.000
		Calculated Value (both directions)	Reduction Factor for Segment TPTI (both directions)		0.063	0.063	0.023	0.075	0.000	0.000	0.000	0.040	0.026	0.086	0.058
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Directional Segment TTTI (direction 1)		0.981	0.981	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Directional Segment TPTI (direction 1)		2.513	2.513	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Directional Segment TTTI (direction 2)		1.482	1.482	#VALUE!	#VALUE!	#VALUE!	1.140	1.140	1.140	1.140	N/A	1.140
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Directional Segment TPTI (direction 2)		18.441	18.441	#VALUE!	#VALUE!	#VALUE!	2.010	2.010	2.010	2.010	N/A	1.893
	FREIGHT INDEX	Value from above	Original Segment TPTI (direction 1)		2.680	2.680	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Value from above	Original Segment TPTI (direction 2)		19.670	19.670	N/A	N/A	N/A	2.010	2.010	2.010	2.010	N/A	2.010
		Calculated Value	Original Segment Freight Index		0.089	0.089	#DIV/0!	#DIV/0!	#DIV/0!	0.498	0.498	0.498	0.498	#DIV/0!	0.498
		Calculated Value	Post-Project Segment TPTI (direction 1)		2.513	2.513	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
		Calculated Value	Post-Project Segment TPTI (direction 2)		18.441	18.441	#VALUE!	#VALUE!	#VALUE!	2.010	2.010	2.010	2.010	N/A	1.893
		Enter in Freight Needs spreadsheet to update segment level Freight Need	Post-Project Segment Freight Index		0.095	0.095	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
	CLOSURE DURATION	Input current value from performance system (direction 1)	Orig Segment Directional Closure Duration (NB/WB)		2.410	2.410	26.320	21.730	27.450	7.710	7.710	7.710	7.710	21.730	7.710
		Input current value from performance system (direction 2)	Orig Segment Directional Closure Duration (SB/EB)		0.700	0.700	40.040	25.560	0.000	127.150	127.150	127.150	127.150	25.560	127.150
		Calculated Value	Segment Closures with fatalities		1	1	3	5	0	4	4	4	4	5	4
		Calculated Value	Total Segment Closures		5	5	5	6	2	7	7	7	7	6	7
		Calculated Value	% Closures with Fatality		0.20	0.20	0.60	0.83	0.00	0.57	0.57	0.57	0.57	0.83	0.57
		Calculated Value	Closure Reduction		0.050	0.050	0.090	0.416	0.000	0.072	0.000	0.053	0.000	0.247	0.222
		Calculated Value	Closure Reduction Factor		0.950	0.950	0.910	0.584	1.000	0.928	1.000	0.947	1.000	0.753	0.778
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Segment Directional Closure Duration (direction 1)		2.290	2.290	23.942	12.700	27.450	7.156	7.710	7.301	7.710	16.370	5.998
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Segment Directional Closure Duration (direction 2)		0.665	0.665	36.422	14.938	0.000	118.013	127.150	127.150	127.150	25.560	98.914
	VERT CLR	Input current value from performance system	Original Segment Vertical Clearance		22.04	22.04	None	No UP	No UP	No UP	No UP	No UP	No UP	No UP	No UP
		Input current value from performance system	Original vertical clearance for specific bridge		22.04	22.04	None	No UP	No UP	No UP	No UP	No UP	No UP	No UP	No UP
		Input post-project value (depends on solution)	Post-Project vertical clearance for specific bridge		22.04	22.04	None	No UP	No UP	No UP	No UP	No UP	No UP	No UP	No UP
		Input post-project value (depends on solution)(force segment clearance to equal this specific bridge)	Post-Project Segment Vertical Clearance		22.04	22.04	None	No UP	No UP	No UP	No UP	No UP	No UP	No UP	No UP
		Enter in Freight Needs spreadsheet to update segment level Freight Need	Post-Project Segment Vertical Clearance		22.04	22.04	None	No UP	No UP	No UP	No UP	No UP	No UP	No UP	No UP
	Needs	User entered value from Freight Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Freight Need		3.736	3.736	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		User entered value from Freight Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Freight Need		3.622	3.622	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

			Solution #	191.1A	191.1B	191.2	70.4-1	70.4-2	70.4-3	70.4-4	70.4-5	70.4-6	70.4-7	70.5
			Description	US 191 Elfrida to I-10 Freight Mitigation: Widen shoulders, realign roadway, replace Cochise RR bridge	US 191 Elfrida to I-10 Freight Mitigation: Construct passing lanes, realign roadway, replace Cochise RR bridge	US191 Safford Safety Improvements	US 70 San Carlos Safety Improvements	US 70 San Carlos Safety Improvements	US 70 San Carlos Safety Improvements	US 70: EB climbing lane	US 70: EB passing lane	US 70: WB passing lane	US 70: WB passing lane	US 70 Cutter Safety Improvements
	LEGEND:		Project Beg MP	59.9	59.9	118	274	270	268	262	267	267	281	257
		- user entered value	Project End MP	64.2	64.2	118	293	274	270	264	270	270	288	259
		- calculated value for reference only	Project Length (miles)	4.3	4.3	0	19	4	2	2	3	3	7	2
		- calculated value for entry/use in other spreadsheet	Segment Beg MP	24	24	116	274	270	255	255	255	255	274	255
		- for input into Performance Effectiveness Score spreadsheet	Segment End MP	67	67	121	293	274	270	270	270	270	293	270
		- assumed values (do not modify)	Segment Length (miles)	43	43	5	19	4	15	15	15	15	19	15
			Segment #	191-2	191-2	191-5	70-10	70-11	70-12	70-12	70-12	70-12	70-10	70-12
			Current # of Lanes (both directions)	2	2	4	2	2	2	2	2	2	2	2
			Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	one-way	one-way	one-way	one-way	two-way
			Additional Lanes (one-way)		1					1	1	1	1	
			Pro-Rated # of Lanes	2.00	2.20	4.00	2.00	2.00	2.00	2.13	2.20	2.20	2.37	2.00
		Notes and Directions	**Description**											
BRIDGE	**BRIDGE INDEX**	Input current value from performance system	Original Segment Bridge Index	5.00	5.00	N/A	7.00	7.54	6.00	6.00	6.00	6.00	7.00	6.00
		Input current value from performance system	Original lowest rating for specific bridge	5	5	N/A	7	5	6	6	6	6	7	6
		Input post-project value (For repair +1, rehab +2, replace=8)	Post-Project lowest rating for specific bridge	8	8	N/A	7	5	6	6	6	6	7	6
		Enter in Bridge Index spreadsheet to calculate new Bridge Index	Post-Project lowest rating for specific bridge	8	8	N/A	7	5	6	6	6	6	7	6
		Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Bridge Index	8	8	N/A	7.00	7.54	6.00	6.00	6.00	6.00	7.00	6.00
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Bridge Index	8.00	8.00	N/A	7.00	7.54	6.00	6.00	6.00	6.00	7.00	6.00
	SUFF RATING	Input current value from performance system	Original Segment Sufficiency Rating	76.93	76.93	N/A	80.00	82.03	63.20	63.20	63.20	63.20	80.00	63.20
		Input current value from performance system	Original Sufficiency Rating for specific bridge	74.30	74.30	N/A	80.00	80.00	63.20	63.20	63.20	63.20	80.00	63.20
		Input post-project value (For repair +10, rehab +20, replace=98)	Post-Project Sufficiency Rating for specific bridge	98.00	98.00	N/A	80.00	80.00	63.20	63.20	63.20	63.20	80.00	63.20
		Enter in Bridge Index spreadsheet to calculate new Bridge Index	Post-Project Sufficiency Rating for specific bridge	98.00	98.00	N/A	80.00	80.00	63.20	63.20	63.20	63.20	80.00	63.20
		Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Sufficiency Rating	98.00	98.00	N/A	80.00	82.03	63.20	63.20	63.20	63.20	80.00	63.20
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Sufficiency Rating	98.00	98.00	N/A	80.00	82.03	63.20	63.20	63.20	63.20	80.00	63.20
	BR RTNG	Input current value from performance system	Original Segment Bridge Rating	5	5	N/A	7	5	6	6	6	6	7	6
		Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Bridge Rating	8	8	N/A	7	5	6	6	6	6	7	6
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Bridge Rating	8	8	N/A	7	5	6	6	6	6	7	6
	% FUN OB	Input current value from performance system	Original Segment % Functionally Obsolete	0.00%	0.00%	N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		Input updated value from updated Bridge Index spreadsheet (only remove bridge from FO if replace or rehab)	Post-Project Segment % Functionally Obsolete	0.00%	0.00%	N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment % Functionally Obsolete	0.00%	0.00%	N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Needs	User entered value from Bridge Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Bridge Need	2.157	2.157	0	0	0.1	0.736	0.736	0.736	0.736	0	0.736
		User entered value from Bridge Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Bridge Need	0	0	0	0	0.1	0.736	0.736	0.736	0.736	0	0.736
PAVEMENT	**PAVEMENT INDEX**	Input current value from performance system	Original Segment Pavement Index	3.06	3.06	3.28	3.87	3.88	3.97	3.97	3.97	3.97	3.87	3.97
		Input current value from performance system	Original Segment IRI in project limits	130.3	130.3	108.61	91.22	90.72	67.52	67.52	67.52	67.52	91.22	67.52
		Input current value from performance system	Original Segment Cracking in project limits	7.6	7.6	6.5	1.6	1.5	3	3	3	3	1.6	3
		Input post-project value (For rehab, increase to 45; for replace increase to 30)	Post-Project IRI in project limits	30	30	45	91.22	90.72	67.52	67.52	67.52	67.52	91.22	67.52
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project IRI in project limits	30	30	45	91.22	90.72	67.52	67.52	67.52	67.52	91.22	67.52
		Input post-project value (Lower to 0 for rehab or replace)	Post-Project Cracking in project limits	0	0	0	1.6	1.5	3	3	3	3	3	3
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project Cracking in project limits	0	0	0	1.6	1.5	3	3	3	3	3	3
		Input updated segment value from updated Pavement Index spreadsheet	Post-Project Segment Pavement Index	3.53	3.53	3.67	3.87	3.88	3.97	3.97	3.97	3.97	3.97	3.97
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Pavement Index	3.53	3.53	3.67	3.87	3.88	3.97	3.97	3.97	3.97	3.97	3.97
	DIRECTION PSR	Input current value from performance system (direction 1)	Original Segment Directional PSR (NB/WB)	3.53	3.53	3.28	3.55	3.55	3.83	3.83	3.83	3.83	3.83	3.83
		Input current value from performance system (direction 2)	Original Segment Directional PSR (SB/EB)	3.53	3.53	3.28	3.55	3.55	3.83	3.83	3.83	3.83	3.83	3.83
		Value from above	Original Segment IRI in project limits	130.3	130.3	108.61	91.22	90.72	67.52	67.52	67.52	67.52	91.22	67.52
		Value from above	Post-Project directional IRI in project limits	30	30	45	91.22	90.72	67.52	67.52	67.52	67.52	91.22	67.52
		Input updated segment value from updated Pavement Index spreadsheet (direction 1)	Post-Project Segment Directional PSR (direction 1)	3.53	3.53	3.64	3.55	3.55	3.83	3.83	3.83	3.83	3.83	3.83
		Input updated segment value from updated Pavement Index spreadsheet (direction 2)	Post-Project Segment Directional PSR (direction 2)	3.53	3.53	3.64	3.55	3.55	3.83	3.83	3.83	3.83	3.83	3.83
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (direction 1)	3.53	3.53	3.64	3.55	3.55	3.83	3.83	3.83	3.83	3.83	3.83
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (direction 2)	3.53	3.53	3.64	3.55	3.55	3.83	3.83	3.83	3.83	3.83	3.83
	% FAIL	Input current value from performance system	Original Segment % Failure	0.0%	0.0%	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Input value from updated Pavement Index spreadsheet	Post-Project Segment % Failure	0.0%	0.0%	0.0%		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment % Failure	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Needs	User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Pavement Need	2.248	2.248	1.074	0.053	0	0	0	0	0	0.053	0
		User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Pavement Need	0.00	0.00	1.074	0.053	0.00	0.00	0.00	0.00	0.00	0.053	0.00

			Solution #	**60.6**	**60.7**	**60.8**	**60.10**	**60.11**	**60.12A**	**60.12B**	**60.12C**	**60.13**	**60.14**
			Description	Pinal Creek Bridge (#36)	Pinal Creek Bridge (#226)	US 60 Globe-Miami Safety Improvements	Queen Creek Bridge (#406)	Waterfall Canyon Bridge (#328)	US 60 Superior to Miami Widen shoulder	US 60 Superior to Miami Climbing/ Passing Lanes	US 60 Superior to Miami Construct New 4-lane divided	US 60 Top-of-the-World Safety Improvements	US 60 Queen Creek Safety Improvements
	LEGEND:		Project Beg MP	249.78	249.61	244.5	227.6	229.47	227	227	227	232	227
		- user entered value	Project End MP	249.8	249.64	250	227.71	229.5	243	243	243	234	229
		- calculated value for reference only	Project Length (miles)	0.02	0.03	5.5	0.11	0.03	16	16	16	2	2
		- calculated value for entry/use in other spreadsheet	Segment Beg MP	243	243	243	227	227	227	227	227	227	227
		- for input into Performance Effectiveness Score spreadsheet	Segment End MP	255	255	255	243	243	243	243	243	243	243
		- assumed values (do not modify)	Segment Length (miles)	12	12	12	16	16	16	16	16	16	16
			Segment #	70/60-13	70/60-13	70/60-13	60-14	60-14	60-14	60-14	60-14	60-14	60-14
			Current # of Lanes (both directions)	4	4	4	2	2	2	2	2	2	2
			Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way
			Additional Lanes (one-way)							1	1		
			Pro-Rated # of Lanes	4.00	4.00	4.00	2.00	2.00	2.00	3.20	4.00	2.00	2.00
		Notes and Directions	**Description**										
SAFETY	DIRECTIONAL SAFETY	Input current value from performance system (direction 1)	Orig Segment Directional Safety Index (NB/WB)	1.640	1.640	1.640	2.230	2.230	2.230	2.230	2.230	2.230	2.230
		Input current value from performance system (direction 1)	Orig Segment Directional Fatal Crashes (NB/WB)	3	3	3	3	3	3	3	3	3	3
		Input current value from performance system (direction 1)	Orig Segment Directional Incap Crashes (NB/WB)	13	13	13	8	8	8	8	8	8	8
		Input current value from performance system (direction 1)	Original Fatal Crashes in project limits (NB/WB)	0	0		0	0	3	3	3	0	1
		Input current value from performance system (direction 1)	Original Incap Crashes in project limits (NB/WB)	0	0		0	0	8	8	8	3	4
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 1 (direction 1)(lowest CMF)	0.95	0.95	Calculated in	0.95	0.95	0.64	0.75	0.67	0.77	0.54
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 2 (direction 1)	1	1	separate	1	1	1	1	1	0.77	0.64
		Input CMF value (direction 1) - If no CMF enter 1.1	CMF 3 (direction 1)	1	1	worksheet	1	1	1	1	1	0.8	0.89
		Input CMF value (direction 1) - If no CMF enter 1.2	CMF 4 (direction 1)	1	1		1	1	1	1	1	0.83	0.83
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 5 (direction 1)	1	1		1	1	1	1	1	0.85	0.77
		Calculated Value (direction 1)	Total CMF (NB/WB)	0.950	0.950	See Worksheet	0.950	0.950	0.900	0.750	0.670	0.519	0.500
		Calculated Value (direction 1)	Fatal Crash reduction (direction 1)	0.000	0.000	2.178	0.000	0.000	0.300	0.750	0.990	0.000	0.500
		Calculated Value (direction 1)	Incap Crash reduction (direction 1)	0.000	0.000	9.313	0.000	0.000	0.800	2.000	2.640	1.443	2.000
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 1)	Post-Project Segment Directional Fatal Crashes (direction 1)	3.000	3.000	0.822	3.000	3.000	2.700	2.250	2.010	3.000	2.500
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 1)	Post-Project Segment Directional Incap Crashes (direction 1)	13.000	13.000	3.687	8.000	8.000	7.200	6.000	5.360	6.557	6.000
		Input value from updated Safety Index spreadsheet (direction 1)	Post-Project Segment Directional Safety Index (direction 1)	1.640	1.640	0.450			2.010	1.680	1.500	2.170	1.830
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need (direction 1)	Post-Project Segment Directional Safety Index (direction 1)	1.640	1.640	0.450	0.000	0.000	2.010	1.680	1.500	2.170	1.830
		Input current value from performance system (direction 2)	Orig Segment Directional Safety Index (SB/EB)	2.550	2.550	2.550	4.230	4.230	4.230	4.230	4.230	4.230	4.230
		Input current value from performance system (direction 2)	Orig Segment Directional Fatal Crashes (direction 2)	5	5	5	6	6	6	6	6	6	6
		Input current value from performance system (direction 2)	Orig Segment Directional Incap Crashes (direction 2)	15	15	15	12	12	12	12	12	12	12
		Input current value from performance system (direction 2)	Original Fatal Crashes in project limits (direction 2)	0	0	5	0	0	6	6	6	2	1
		Input current value from performance system (direction 2)	Original Incap Crashes in project limits (direction 2)	0	0	15	1	0	12	12	12	2	2
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 1 (direction 2)(lowest CMF)	0.95	0.95	0.64	0.95	0.95	0.64	0.75	0.67	0.77	0.54
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 2 (direction 2)	1	1	0.89	1	1	1	1	1	0.77	0.64
		Input CMF value (direction 2) - If no CMF enter 1.1	CMF 3 (direction 2)	1	1	1	1	1	1	1	1	0.8	0.75
		Input CMF value (direction 2) - If no CMF enter 1.2	CMF 4 (direction 2)	1	1	1	1	1	1	1	1	0.83	0.87
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 5 (direction 2)	1	1	1	1	1	1	1	1	0.85	0.89
		Calculated Value (direction 2)	Total CMF (direction 2)	0.950	0.950	See Worksheet	0.950	0.950	0.900	0.750	0.670	0.519	0.500
		Calculated Value (direction 2)	Fatal Crash reduction (direction 2)	0.000	0.000	4.201	0.000	0.000	0.600	1.500	1.980	0.962	0.500
		Calculated Value (direction 2)	Incap Crash reduction (direction 2)	0.000	0.000	11.467	0.050	0.000	1.200	3.000	3.960	0.962	1.000
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 2)	Post-Project Segment Directional Fatal Crashes (direction 2)	5.000	5.000	0.799	6.000	6.000	5.400	4.500	4.020	5.038	5.500
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 2)	Post-Project Segment Directional Incap Crashes (direction 2)	15.000	15.000	3.533	11.950	12.000	10.800	9.000	8.040	11.038	11.000
		Input value from updated Safety Index spreadsheet (direction 2)	Post-Project Segment Directional Safety Index (direction 2)	2.550	2.550	0.440			3.810	3.180	2.840	3.570	3.880
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need (direction 2)	Post-Project Segment Directional Safety Index (direction 2)	2.550	2.550	0.440	0.000	0.000	3.810	3.180	2.840	3.570	3.880
	SAFETY INDEX	Calculated Value - verify that it matches current performance system	Current Safety Index	2.095	2.095	2.095	3.230	3.230	3.230	3.230	3.230	3.230	3.230
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need	Post-Project Safety Index	2.095	2.095	0.446	0.000	0.000	2.910	2.430	2.170	2.870	2.860
	Needs	User entered value from Safety Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Safety Need	6.418	6.418	6.418	11.646	11.646	11.646	11.646	11.646	11.646	11.646
		User entered value from Safety Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Safety Need	6.418	6.418	3.354	11.554	11.646	5.484	8.905	8.078	10.255	10.198

			Solution #	**60.6**	**60.7**	**60.8**	**60.10**	**60.11**	**60.12A**	**60.12B**	**60.12C**	**60.13**	**60.14**
			Description	Pinal Creek Bridge (#36)	Pinal Creek Bridge (#226)	US 60 Globe-Miami Safety Improvements	Queen Creek Bridge (#406)	Waterfall Canyon Bridge (#328)	US 60 Superior to Miami Widen shoulder	US 60 Superior to Miami Climbing/ Passing Lanes	US 60 Superior to Miami Construct New 4-lane divided	US 60 Top-of-the-World Safety Improvements	US 60 Queen Creek Safety Improvements
	LEGEND:		Project Beg MP	249.78	249.61	244.5	227.6	229.47	227	227	227	232	227
		- user entered value	Project End MP	249.8	249.64	250	227.71	229.5	243	243	243	234	229
		- calculated value for reference only	Project Length (miles)	0.02	0.03	5.5	0.11	0.03	16	16	16	2	2
		- calculated value for entry/use in other spreadsheet	Segment Beg MP	243	243	243	227	227	227	227	227	227	227
		- for input into Performance Effectiveness Score spreadsheet	Segment End MP	255	255	255	243	243	243	243	243	243	243
		- assumed values (do not modify)	Segment Length (miles)	12	12	12	16	16	16	16	16	16	16
			Segment #	70/60-13	70/60-13	70/60-13	60-14	60-14	60-14	60-14	60-14	60-14	60-14
			Current # of Lanes (both directions)	4	4	4	2	2	2	2	2	2	2
			Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way
			Additional Lanes (one-way)							1	1		
			Pro-Rated # of Lanes	4.00	4.00	4.00	2.00	2.00	2.00	3.20	4.00	2.00	2.00
		Notes and Directions	**Description**										
MOBILITY	**MOBILITY INDEX**	Input current value from performance system	Original Segment Mobility Index	0.400	0.400	0.400	1.730	1.730	1.730	1.730	1.730	1.730	1.730
		Enter in Mobility Index Spreadsheet to determine new segment level Mobility Index	Post-Project # of Lanes (both directions)	4.00	4.00	4.00	2.00	2.00	2.00	3.20	4.00	2.00	2.00
		Input value from updated Mobility Index spreadsheet	Post-Project Segment Mobility Index	0.40	0.40	0.40	1.73	1.73	1.73	0.34	0.27	1.73	1.73
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Mobility Index	0.400	0.400	0.400	1.730	1.730	1.730	0.340	0.270	1.730	1.730
	FUT V/C	Input current value from performance system	Original Segment Future V/C	0.460	0.460	0.460	2.110	2.110	2.110	2.110	2.110	2.110	2.110
		Input value from updated Mobility Index spreadsheet	Post-Project Segment Future V/C	0.460	0.460	0.460	2.110	2.110	2.110	0.410	0.330	2.110	2.110
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Future V/C	0.460	0.460	0.460	2.110	2.110	2.110	0.410	0.330	2.110	2.110
	PEAK HOUR V/C	Input current value from performance system (direction 1)	Original Segment Peak Hour V/C (NB/WB)	0.290	0.290	0.290	1.220	1.220	1.220	1.220	1.220	1.220	1.220
		Input current value from performance system (direction 2)	Original Segment Peak Hour V/C (SB/EB)	0.300	0.300	0.300	1.090	1.090	1.090	1.090	1.090	1.090	1.090
		***If One-Way project**, enter in Mobility Index Spreadsheet to determine new segment level Peak Hour V/C. **If Two-Way project,** disregard	Adjusted total # of Lanes for use in directional peak hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Input value from updated Mobility Index spreadsheet (direction 1)	Post-Project Segement Peak Hr V/C (NB/WB)	0.29	0.29	0.29	1.220	1.220	1.220	0.240	0.19	1.220	1.220
		Input value from updated Mobility Index spreadsheet (direction 2)	Post-Project Segement Peak Hr V/C (SB/EB)	0.30	0.30	0.30	1.090	1.090	1.090	0.210	0.17	1.090	1.090
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Peak Hr V/C (direction 1)	0.290	0.290	0.290	1.220	1.220	1.220	0.240	0.190	1.220	1.220
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Peak Hr V/C (direction 2)	0.300	0.300	0.300	1.090	1.090	1.090	0.210	0.170	1.090	1.090
	TTI AND PTI	Calculated Value (both directions)	Safety Reduction Factor	1.000	1.000	0.213	0.000	0.000	0.901	0.752	0.672	0.889	0.885
		Calculated Value (both directions)	Safety Reduction	0.000	0.000	0.787	1.000	1.000	0.099	0.248	0.328	0.111	0.115
		Calculated Value (both directions)	Mobility Reduction Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.197	0.156	1.000	1.000
		Calculated Value (both directions)	Mobility Reduction	0.000	0.000	0.000	0.000	0.000	0.000	0.803	0.844	0.000	0.000
		Input current value from performance system (direction 1)	Original Directional Segment TTI (NB/WB)	1.150	1.150	1.150	1.070	1.070	1.070	1.070	1.070	1.070	1.070
		Input current value from performance system (direction 1)	Original Directional Segment PTI (NB/WB)	2.720	2.720	2.720	1.470	1.470	1.470	1.470	1.470	1.470	1.470
		Input current value from performance system (direction 2)	Original Directional Segment TTI (SB/EB)	1.310	1.310	1.310	1.190	1.190	1.190	1.190	1.190	1.190	1.190
		Input current value from performance system (direction 2)	Original Directional Segment PTI (SB/EB)	3.360	3.360	3.360	2.060	2.060	2.060	2.060	2.060	2.060	2.060
		Calculated Value (both directions)	Reduction Factor for Segment TTI	0.000	0.000	0.000	0.000	0.000	0.000	0.241	0.253	0.000	0.000
		Calculated Value (both directions)	Reduction Factor for Segment PTI	0.000	0.000	0.236	0.300	0.300	0.030	0.235	0.267	0.033	0.034
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Directional Segment TTI (direction 1)	1.150	1.150	1.150	1.070	1.070	1.070	1.035	1.035	1.070	1.070
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Directional Segment PTI (direction 1)	2.720	2.720	2.078	1.029	1.029	1.426	1.125	1.077	1.421	1.419
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Directional Segment TTTI (direction 2)	1.310	1.310	1.310	1.190	1.190	1.190	1.095	1.095	1.190	1.190
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Directional Segment TPTI (direction 2)	3.360	3.360	2.567	1.442	1.442	1.999	1.576	1.51	1.991	1.989
	CLOSURE EXTENT	Input current value from performance system (direction 1)	Orig Segment Directional Closure Extent (NB/WB)	0.000	0.000	0.000	0.330	0.330	0.330	0.330	0.330	0.330	0.330
		Input current value from performance system (direction 2)	Orig Segment Directional Closure Extent (SB/EB)	0.120	0.120	0.120	1.570	1.570	1.570	1.570	1.570	1.570	1.570
		Input value from HCRS	Segment Closures with fatalities/injuries	1	1	1	15	15	15	15	15	15	15
		Input value from HCRS	Total Segment Closures	7	7	7	47	47	47	47	47	47	47
		Calculated Value (both directions)	% Closures with Fatality/Injury	0.14	0.14	0.14	0.32	0.32	0.32	0.32	0.32	0.32	0.32
		Calculated Value (both directions)	Closure Reduction	0.000	0.000	0.112	0.319	0.319	0.032	0.079	0.105	0.036	0.037
		Calculated Value (both directions)	Closure Reduction Factor	1.000	1.000	0.888	0.681	0.681	0.968	0.921	0.895	0.964	0.963
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Segment Directional Closure Extent (direction 1)	0.000	0.000	0.000	0.225	0.225	0.320	0.304	0.295	0.318	0.318
		Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Segment Directional Closure Extent (direction 2)	0.120	0.120	0.107	1.069	1.069	1.520	1.446	1.406	1.514	1.513
	BICYCLE ACCOM	Input current value from performance system	Orig Segment Bicycle Accomodation %	54.0%	54.0%	54.0%	49.0%	49.0%	49.0%	49.0%	49.0%	49.0%	49.0%
		Input current value from performance system	Orig Segment Outside Shoulder width	5	5	5	5	5	5	5	5	5	5
		Input value from updated Mobility Index spreadsheet	Post-Project Segment Outside Shoulder width	14	14	14	14	14	14	5	5	5	5
		Input value from updated Mobility Index spreadsheet	Post-Project Segment Bicycle Accomodation (%)	65.0%	65.0%	100.0%	100.0%	100.0%	100.0%	49.0%	100.0%	100.0%	100.0%
		Enter in Mobiity Needs spreadsheet to calculate new segment level Mobility Need	Post-Project Segment Bicycle Accomodation (%)	65.0%	65.0%	100.0%	100.0%	100.0%	100.0%	49.0%	100.0%	100.0%	100.0%
	Needs	User entered value from Mobility Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Mobility Need	0.991	0.991	0.991	14.691	14.691	14.691	14.691	14.691	14.691	14.691
		User entered value from Mobility Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Mobility Need	0.881	0.881	0.521	14.537	14.537	13.762	1.312	1.168	13.796	13.795

			Solution #	**60.6**	**60.7**	**60.8**	**60.10**	**60.11**	**60.12A**	**60.12B**	**60.12C**	**60.13**	**60.14**
			Description	Pinal Creek Bridge (#36)	Pinal Creek Bridge (#226)	US 60 Globe-Miami Safety Improvements	Queen Creek Bridge (#406)	Waterfall Canyon Bridge (#328)	US 60 Superior to Miami Widen shoulder	US 60 Superior to Miami Climbing/ Passing Lanes	US 60 Superior to Miami Construct New 4-lane divided	US 60 Top-of-the-World Safety Improvements	US 60 Queen Creek Safety Improvements
	LEGEND:		Project Beg MP	249.78	249.61	244.5	227.6	229.47	227	227	227	232	227
		- user entered value	Project End MP	249.8	249.64	250	227.71	229.5	243	243	243	234	229
		- calculated value for reference only	Project Length (miles)	0.02	0.03	5.5	0.11	0.03	16	16	16	2	2
		- calculated value for entry/use in other spreadsheet	Segment Beg MP	243	243	243	227	227	227	227	227	227	227
		- for input into Performance Effectiveness Score spreadsheet	Segment End MP	255	255	255	243	243	243	243	243	243	243
		- assumed values (do not modify)	Segment Length (miles)	12	12	12	16	16	16	16	16	16	16
			Segment #	70/60-13	70/60-13	70/60-13	60-14	60-14	60-14	60-14	60-14	60-14	60-14
			Current # of Lanes (both directions)	4	4	4	2	2	2	2	2	2	2
			Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way
			Additional Lanes (one-way)							1	1		
			Pro-Rated # of Lanes	4.00	4.00	4.00	2.00	2.00	2.00	3.20	4.00	2.00	2.00
		Notes and Directions	**Description**										
FREIGHT	TTTI AND TPTI	Input current value from performance system (direction 1)	Original Directional Segment TTTI (NB/WB)	1.240	1.240	1.240	1.180	1.180	1.180	1.180	1.180	1.180	1.180
		Input current value from performance system (direction 1)	Original Directional Segment TPTI (NB/WB)	4.290	4.290	4.290	2.340	2.340	2.340	2.340	2.340	2.340	2.340
		Input current value from performance system (direction 2)	Original Directional Segment TTTI (SB/EB)	1.480	1.480	1.480	1.600	1.600	1.600	1.600	1.600	1.600	1.600
		Input current value from performance system (direction 2)	Original Directional Segment TPTI (SB/EB)	6.190	6.190	6.190	2.360	2.360	2.360	2.360	2.360	2.360	2.360
		Calculated Value (both directions)	Reduction Factor for Segment TTTI (both directions)	0.000	0.000	0.000	0.000	0.000	0.000	0.121	0.127	0.000	0.000
		Calculated Value (both directions)	Reduction Factor for Segment TPTI (both directions)	0.000	0.000	0.118	0.000	0.000	0.015	0.117	0.134	0.017	0.017
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Directional Segment TTTI (direction 1)	1.240	1.240	1.240	1.180	1.180	1.180	1.038	1.031	1.180	1.180
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Directional Segment TPTI (direction 1)	4.290	4.290	3.783	2.340	2.340	2.305	2.065	2.027	2.301	2.300
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Directional Segment TTTI (direction 2)	1.480	1.480	1.480	1.600	1.600	1.600	1.407	1.397	1.600	1.600
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Directional Segment TPTI (direction 2)	6.190	6.190	5.459	2.360	2.360	2.325	2.083	2.045	2.321	2.319
	FREIGHT INDEX	Value from above	Original Segment TPTI (direction 1)	4.290	4.290	4.290	2.340	2.340	2.340	2.340	2.340	2.340	2.340
		Value from above	Original Segment TPTI (direction 2)	6.190	6.190	6.190	2.360	2.360	2.360	2.360	2.360	2.360	2.360
		Calculated Value	Original Segment Freight Index	0.191	0.191	0.191	0.426	0.426	0.426	0.426	0.426	0.426	0.426
		Calculated Value	Post-Project Segment TPTI (direction 1)	4.290	4.290	3.783	2.340	2.340	2.305	2.065	2.027	2.301	2.300
		Calculated Value	Post-Project Segment TPTI (direction 2)	6.190	6.190	5.459	2.360	2.360	2.325	2.083	2.045	2.321	2.319
		Enter in Freight Needs spreadsheet to update segment level Freight Need	Post-Project Segment Freight Index	0.191	0.191	0.216	0.426	0.426	0.432	0.482	0.491	0.433	0.433
	CLOSURE DURATION	Input current value from performance system (direction 1)	Orig Segment Directional Closure Duration (NB/WB)	0.000	0.000	0.000	68.540	68.540	68.540	68.540	68.540	68.540	68.540
		Input current value from performance system (direction 2)	Orig Segment Directional Closure Duration (SB/EB)	19.070	19.070	19.070	378.720	378.720	378.720	378.720	378.720	378.720	378.720
		Calculated Value	Segment Closures with fatalities	1	1	1	15	15	15	15	15	15	15
		Calculated Value	Total Segment Closures	7	7	7	47	47	47	47	47	47	47
		Calculated Value	% Closures with Fatality	0.14	0.14	0.14	0.32	0.32	0.32	0.32	0.32	0.32	0.32
		Calculated Value	Closure Reduction	0.000	0.000	0.112	0.319	0.319	0.032	0.079	0.105	0.036	0.037
		Calculated Value	Closure Reduction Factor	1.000	1.000	0.888	0.681	0.681	0.968	0.921	0.895	0.964	0.963
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Segment Directional Closure Duration (direction 1)	0.000	0.000	0.000	46.666	46.666	66.373	63.122	61.361	66.102	66.034
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Segment Directional Closure Duration (direction 2)	19.070	19.070	16.926	257.852	257.852	366.745	348.784	339.054	365.249	364.874
	VERT CLR	Input current value from performance system	Original Segment Vertical Clearance	15.84	15.84	15.84	13.03	13.03	13.03	13.03	13.03	13.03	13.03
		Input current value from performance system	Original vertical clearance for specific bridge	15.84	15.84	15.84	13.03	13.03	13.03	13.03	13.03	13.03	13.03
		Input post-project value (depends on solution)	Post-Project vertical clearance for specific bridge	15.84	15.84	15.84	13.03	13.03	13.03	13.03	13.03	13.03	13.03
		Input post-project value (depends on solution)(force segment clearance to equal this specific bridge)	Post-Project Segment Vertical Clearance	15.84	15.84	15.84	13.03	13.03	13.03	13.03	13.03	13.03	13.03
		Enter in Freight Needs spreadsheet to update segment level Freight Need	Post-Project Segment Vertical Clearance	15.84	15.84	15.84	13.03	13.03	13.03	13.03	13.03	13.03	13.03
	Needs	User entered value from Freight Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Freight Need	2.7	2.7	2.7	6.2	6.2	6.2	6.2	6.2	6.2	6.2
		User entered value from Freight Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Freight Need	2.7	2.7	2.5	6.2	6.2	5.9	5.5	5.4	6.1	6.1

			Solution #	60.6	60.7	60.8	60.10	60.11	60.12A	60.12B	60.12C	60.13	60.14
			Description	Pinal Creek Bridge (#36)	Pinal Creek Bridge (#226)	US 60 Globe-Miami Safety Improvements	Queen Creek Bridge (#406)	Waterfall Canyon Bridge (#328)	US 60 Superior to Miami Widen shoulder	US 60 Superior to Miami Climbing/ Passing Lanes	US 60 Superior to Miami Construct New 4-lane divided	US 60 Top-of-the-World Safety Improvements	US 60 Queen Creek Safety Improvements
	LEGEND:		Project Beg MP	249.78	249.61	244.5	227.6	229.47	227	227	227	232	227
		- user entered value	Project End MP	249.8	249.64	250	227.71	229.5	243	243	243	234	229
		- calculated value for reference only	Project Length (miles)	0.02	0.03	5.5	0.11	0.03	16	16	16	2	2
		- calculated value for entry/use in other spreadsheet	Segment Beg MP	243	243	243	227	227	227	227	227	227	227
		- for input into Performance Effectiveness Score spreadsheet	Segment End MP	255	255	255	243	243	243	243	243	243	243
		- assumed values (do not modify)	Segment Length (miles)	12	12	12	16	16	16	16	16	16	16
			Segment #	70/60-13	70/60-13	70/60-13	60-14	60-14	60-14	60-14	60-14	60-14	60-14
			Current # of Lanes (both directions)	4	4	4	2	2	2	2	2	2	2
			Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way
			Additional Lanes (one-way)							1	1		
			Pro-Rated # of Lanes	4.00	4.00	4.00	2.00	2.00	2.00	3.20	4.00	2.00	2.00
		Notes and Directions	**Description**										
BRIDGE	BRIDGE INDEX	Input current value from performance system	Original Segment Bridge Index	5.17	5.17	5.17	4.56	4.56	4.56	4.56	4.56	4.56	4.56
		Input current value from performance system	Original lowest rating for specific bridge	4	4	4	4	4	4	4	4	4	4
		Input post-project value (For repair +1, rehab +2, replace=8)	Post-Project lowest rating for specific bridge	4	4	4	4	4	4	4	4	4	4
		Enter in Bridge Index spreadsheet to calculate new Bridge Index	Post-Project lowest rating for specific bridge	8	8	4	8	8	4	4	4	4	4
		Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Bridge Index	5.32	5.44	5.17	5.39	4.72	4.56	4.56	4.56	4.56	4.56
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Bridge Index	5.32	5.44	5.17	5.39	4.72	4.56	4.56	4.56	4.56	4.56
	SUFF RATING	Input current value from performance system	Original Segment Sufficiency Rating	78.89	78.89	78.89	36.03	36.03	36.03	36.03	36.03	36.03	36.03
		Input current value from performance system	Original Sufficiency Rating for specific bridge	45.20	45.20	45.20	27	27	27	27	27	27	27
		Input post-project value (For repair +10, rehab +20, replace=98)	Post-Project Sufficiency Rating for specific bridge	100.00	100.00	45.20	100	100	27	27	27	27	27
		Enter in Bridge Index spreadsheet to calculate new Bridge Index	Post-Project Sufficiency Rating for specific bridge	100.00	100.00	45.20	100.00	100.00	26.80	26.80	26.80	26.80	26.80
		Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Sufficiency Rating	100.00	100.00	78.89	100.00	100.00	36.03	36.03	36.03	36.03	36.03
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Sufficiency Rating	100.00	100.00	78.89	100.00	100.00	36.03	36.03	36.03	36.03	36.03
	BR RTNG	Input current value from performance system	Original Segment Bridge Rating	4	4	4	4	4	4	4	4	4	4
		Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Bridge Rating	8	8	4	8	8	4	4	4	4	4
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Bridge Rating	8	8	4	8	8	4	4	4	4	4
	% FUN OB	Input current value from performance system	Original Segment % Functionally Obsolete	49.40%	49.40%	49.40%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		Input updated value from updated Bridge Index spreadsheet (only remove bridge from FO if replace or rehab)	Post-Project Segment % Functionally Obsolete	0.00%	0.00%	49.40%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment % Functionally Obsolete	0.00%	0.00%	49.40%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Needs	User entered value from Bridge Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Bridge Need	2.292	2.578	2.397	3.262	3.241	3.264	3.264	3.264	3.264	3.264
		User entered value from Bridge Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Bridge Need	0.000	0.000	2.397	0.000	0.000	3.264	1.6	1.6	3.264	3.264
PAVEMENT	PAVEMENT INDEX	Input current value from performance system	Original Segment Pavement Index	3.65	3.65	3.65	3.43	3.43	3.43	3.43	3.43	3.43	3.43
		Input current value from performance system	Original Segment IRI in project limits	108.6	108.6	108.6	116.83	116.83	116.83	116.83	116.83	116.83	116.83
		Input current value from performance system	Original Segment Cracking in project limits	1.2	1.2	1.2	4.4	4.4	4.4	4.4	4.4	4.4	4.4
		Input post-project value (For rehab, increase to 45; for replace increase to 30)	Post-Project IRI in project limits	108.6	108.6	108.6	116.83	116.83	116.83	116.83	73.415	116.83	116.83
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project IRI in project limits	108.6	108.6	108.6	116.83	116.83	116.83	116.83	73.415	116.83	116.83
		Input post-project value (Lower to 0 for rehab or replace)	Post-Project Cracking in project limits	1.2	1.2	1.2	4.4	4.4	4.4	4.4	2.2	4.4	4.4
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project Cracking in project limits	1.2	1.2	1.2	4.4	4.4	4.4	4.4	2.2	4.4	4.4
		Input updated segment value from updated Pavement Index spreadsheet	Post-Project Segment Pavement Index	3.65	3.65	3.65	3.43	3.43	3.43	3.43	4.02	3.43	3.43
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Pavement Index	3.65	3.65	3.65	3.43	3.43	3.43	3.43	4.02	3.43	3.43
	DIRECTION PSR	Input current value from performance system (direction 1)	Original Segment Directional PSR (NB/WB)	3.43	3.43	3.43	3.24	3.24	3.24	3.24	3.24	3.24	3.24
		Input current value from performance system (direction 2)	Original Segment Directional PSR (SB/EB)	3.9	3.9	3.9	3.24	3.24	3.24	3.24	0	3.24	3.24
		Value from above	Original Segment IRI in project limits	108.6	108.6	108.6	116.83	116.83	116.83	116.83	116.83	116.83	116.83
		Value from above	Post-Project directional IRI in project limits	108.6	108.6	108.6	116.83	116.83	116.83	116.83	73.415	116.83	116.83
		Input updated segment value from updated Pavement Index spreadsheet (direction 1)	Post-Project Segment Directional PSR (direction 1)	3.43	3.43	3.43	3.24	3.24	3.24	3.24	3.24	3.24	3.24
		Input updated segment value from updated Pavement Index spreadsheet (direction 2)	Post-Project Segment Directional PSR (direction 2)	3.9	3.9	3.9	3.24	3.24	3.24	3.24	4.46	3.24	3.24
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (direction 1)	3.43	3.43	3.43	3.24	3.24	3.24	3.24	3.24	3.24	3.24
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (direction 2)	3.9	3.9	3.9	3.24	3.24	3.24	3.24	4.46	3.24	3.24
	% FAIL	Input current value from performance system	Original Segment % Failure	19.0%	19.0%	19.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%	31.0%
		Input value from updated Pavement Index spreadsheet	Post-Project Segment % Failure	19.0%	19.0%	19.0%	31.0%	31.0%	31.0%	31.0%	15.6%	31.0%	31.0%
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment % Failure	19.0%	19.0%	19.0%	31.0%	31.0%	31.0%	31.0%	15.6%	31.0%	31.0%
	Needs	User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Pavement Need	0.4	0.4	0.4	0.9	0.9	0.9	0.9	0.9	0.9	0.9
		User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Pavement Need	0.4	0.4	0.4	0.9	0.9	0.9	0.9	0.390	0.9	0.9

APPENDIX F: SOLUTION PRIORITIZATION SCORES

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Pavement		Bridge		Safety		Mobility		Freight		Total Factored Score	Risk Factors					Weighted Risk Factor	Segment Need	Prioritization Score
				Score	%	Score	%	Score	%	Score	%	Score	%		Pavement	Bridge	Safety	Mobility	Freight			
191.1A	US 191 Elfrida to I-10 Freight Mitigation: Widen shoulders, realign roadway, replace Cochise RR bridge	59.9-64	105.6	0.821	5.4%	7.377	48.3%	0.018	0.1%	6.197	40.5%	0.871	5.7%	15.285	1.14	1.51	1.78	1.36	1.36	1.421	1.38	**2**
191.1B	US 191 Elfrida to I-10 Freight Mitigation: Construct passing lanes, realign roadway, replace Cochise RR bridge	59.9-64	121.5	0.821	4.2%	7.377	38.0%	0.018	0.1%	10.317	53.2%	0.871	4.5%	19.405	1.14	1.51	1.78	1.36	1.36	1.408	1.38	**2**
191.2	US191 Safford Safety Improvements	117-121	1.4	0.000	0.0%	0.000	0.0%	5.383	99.7%	0.015	0.3%	0.000	0.0%	5.398	1.14	1.51	1.78	1.36	1.36	1.779	2.00	**114**
70.4	US 70 San Carlos Safety Improvements	268-292	46.1	0.000	0.0%	0.000	0.0%	11.031	71.2%	4.456	28.8%	0.000	0.0%	15.487	1.14	1.51	1.78	1.36	1.36	1.659	1.40	**34**
70.5	US 70 Cutter Safety Improvements	257-260	5.6	0.000	0.0%	0.000	0.0%	4.879	56.3%	3.794	43.7%	0.000	0.0%	8.673	1.14	1.51	1.78	1.36	1.36	1.596	1.31	**27**
60.6	Pinal Creek Bridge (#36)	249.8	2.400	0.000	0.0%	9.718	96.4%	0.000	0.0%	0.361	3.6%	0.000	0.0%	10.079	1.14	1.51	1.78	1.36	1.36	1.505	2.23	**123**
60.7	Pinal Creek Bridge (#226)	249.64	3.100	0.000	0.0%	10.931	87.6%	0.000	0.0%	1.542	12.4%	0.000	0.0%	12.472	1.14	1.51	1.78	1.36	1.36	1.491	2.23	**117**
60.8	US 60 Globe-Miami Safety Improvements	244.5-251	10.2	0.084	0.3%	0.000	0.0%	23.480	87.7%	2.204	8.2%	1.004	3.8%	26.772	1.14	1.51	1.78	1.36	1.36	1.728	2.23	**440**
60.9	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	253.4-253.8	1.1	0.000	0.0%	0.000	0.0%	0.000	0.0%	0.000	0.0%	3.514	100.0%	3.514	1.14	1.51	1.78	1.36	1.36	1.360	2.23	**44**
60.10	Queen Creek Bridge (#406)	227.71	8.800	0.000	0.0%	12.493	89.6%	0.289	2.1%	1.160	8.3%	0.000	0.0%	13.942	1.14	1.51	1.78	1.36	1.36	1.503	2.00	**127**
60.11	Waterfall Canyon Bridge (#328)	229.5	1.700	0.000	0.0%	12.413	94.1%	0.000	0.0%	0.772	5.9%	0.000	0.0%	13.185	1.14	1.51	1.78	1.36	1.36	1.501	2.00	**506**
60.12A	US 60 Superior to Miami Widen Shoulder	227-243	11.3	0.000	0.0%	0.000	0.0%	5.691	33.2%	8.985	52.5%	2.454	14.3%	17.130	1.14	1.51	1.78	1.36	1.36	1.500	2.00	**303**
60.12B	US 60 Superior to Miami Climbing/ Passing Lanes	227-243	113.6	0.166	0.1%	6.373	4.0%	17.773	11.2%	129.377	81.3%	5.527	3.5%	159.216	1.14	1.51	1.78	1.36	1.36	1.413	2.00	**350**
60.12C	US 60 Superior to Miami Construct New 4-Lane Divided	227-243	157.2	0.849	0.5%	6.373	3.9%	20.959	12.7%	130.769	79.1%	6.408	3.9%	165.358	1.14	1.51	1.78	1.36	1.36	1.418	2.00	**264**
60.13	US 60 Top-of-the-World Safety Improvements	232-234	1	0.000	0.0%	0.000	0.0%	6.527	89.0%	0.002	0.0%	0.801	10.9%	7.329	1.14	1.51	1.78	1.36	1.36	1.734	2.00	**435**
60.14	US 60 Queen Creek Safety Improvements	227-229	2.7	0.000	0.0%	0.000	0.0%	6.653	89.2%	0.002	0.0%	0.801	10.7%	7.456	1.14	1.51	1.78	1.36	1.36	1.735	2.00	**164**